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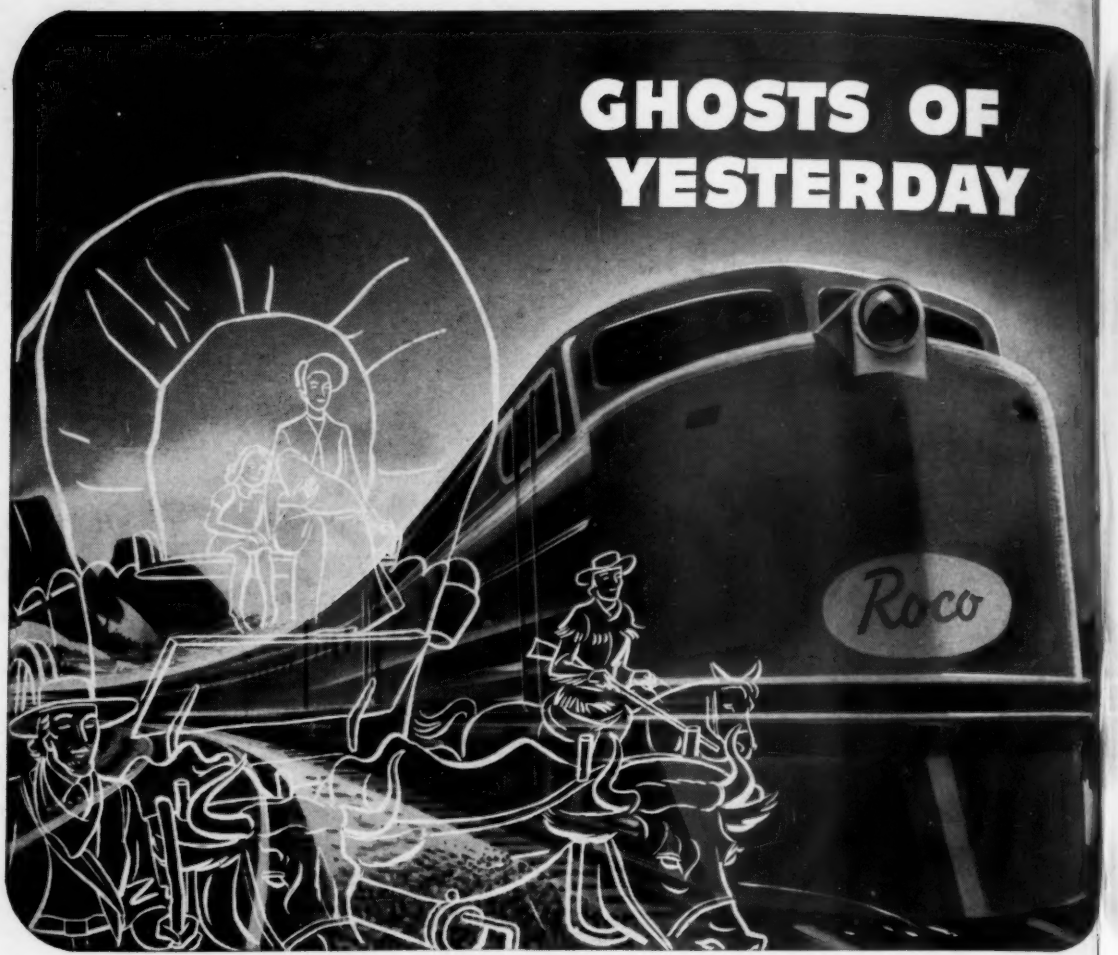

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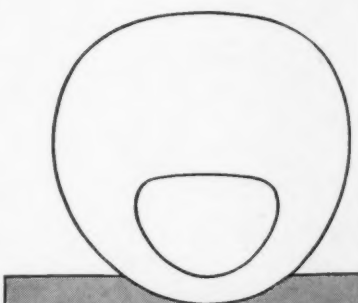

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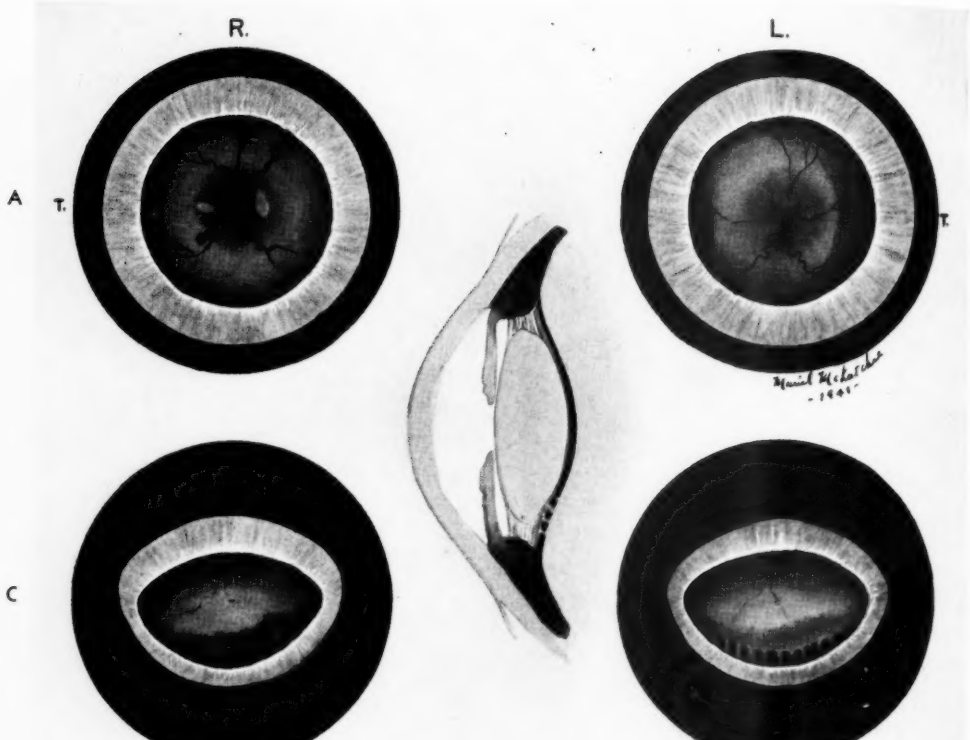

FIG. 1 (TERRY). A AND B, APPEARANCE AS SEEN LOOKING DIRECTLY THROUGH DILATED PUPIL WITH AN OPHTHALMOSCOPE, USING A +10 SPHERE FOR MAGNIFICATION. SIZE OF VESSELS IN MEMBRANE IS EXAGGERATED SO THAT THEY CAN BE SEEN READILY.

CENTER FIGURE IS A DIAGRAM TO SHOW LOCATION OF THE MEMBRANE, INDICATED BY A DARK LINE AT THE BACK OF THE LENS.

C AND D, APPEARANCE OF SERRATED EDGE OF MEMBRANE AT EXTREME PERIPHERY BELOW. PUPIL OVAL TO INDICATE OBLIQUE VIEW.

R. AND L. INDICATE RIGHT AND LEFT EYES, RESPECTIVELY: T, TEMPORAL SIDE. EYE MOVEMENTS INTERFERED WITH EXACT DETERMINATION OF NUMBER AND LOCATION OF VESSELS ON MEMBRANE AS WELL AS NUMBER AND SIZE OF DENTATE PROCESSES BELOW.

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SOME OF THE MOST IMPORTANT OCULAR AND ORBITAL WOUNDS IN WAR

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New York

In a war as gigantic as the last one, with so many men engaged with instruments of destruction of all kinds, one can readily see that every conceivable injury may be incurred by the human eye and its appendages. On account of the ingenious devices which science has created for the wholesale slaughter of thousands of men in a few minutes, it is certainly not surprising that there are many interesting, weird, and freak cases in all branches of medicine and surgery. This is most certainly true of ophthalmology. Plastic surgery of the lids and of the orbit can not be dealt with at length in a paper of this kind, but I will briefly mention a few interesting facts regarding these conditions.

Before discussing the present topic it would be well to study the anatomy, especially the protective anatomy, of the eyeball, and then to emphasize some interesting facts which were classified by eminent ophthalmologists. I wish also to stress and point out a number of interesting conditions that are not ordinarily met with among the routine clinic cases of our well-known hospitals.

If we make a critical examination of the human skull from the standpoint of the protective role that the cranial bones play in safeguarding its contents, our attention may first be fixed upon the sutures of these bones that go to make up the architecture of the skull. It is reasonable to suppose that the force of any blow on the head will be lessened because of this beautiful interlacing of the cranial components. The vibrations caused by this shock to the head are thereby thrown into so many irregular waves of force that some tend to neutralize each other and others gradually to lessen in intensity as they pass from bone to bone and are lost in the bony skeleton.

Upon examining the bones of the cranium and orbit, we find that they are composed of two walls filled in with bone marrow. This is indeed the most favorable construction to withstand the penetrating force of projection, for it is a well-known law of physics that any projectile will lose its force in passing through media of different density.

In examining the orbit, and as Dr. Félix Lagrange has pointed out, a blow in striking the upper orbital arch produces vibrations that will be communicated to the internal and external orbital processes of the frontal bone and dispersed in the facial mass; the contrary is true when a blow strikes the inferior part of the orbit. The vibrations are lost in the cranial mass by means of the orbital processes of the frontal bone. A blow on the external wall of the orbit meets stout resistance as the retrocussions are transmitted from the malar bone to the frontal and superior maxillary, while the zygomatic arch resists the shock by transmitting the force of the blow to the temporal bone.

The wall of the orbital cavity is also extremely resistant to external trauma, being solid below and well protected on the outside by the normal musculature of the face. It is thin above and fragile within, but here, again, nature has provided an excellent shock absorber to any blow having sufficient force to cause a fracture; namely, the concavity formed by the sphenoidal and spheno-maxillary fissures. The internal wall is protected by its fellow of the opposite side. Because of the thinness of the superior wall and its continuation as orbital wall it is most often injured.

The vulnerability of the orbit is due to its important orifices. Let us first consider the base. While at first this may seem an easy entrance for any foreign body, this open space is rapidly decreased by a slight tilting of the head, up or down or from side to side. It is certainly reasonable to suppose that any individual sensing danger will not assume a perfectly erect position. The other avenues of exit are the optic foramen, the sphenoidal fissure, and the pterygo-maxillary fossa. But the internal wall covering the ethmoids can hardly be considered a barrier; it is not a direct communication, but its resisting power is practically nil, so that sanguinary effusions easily find their way from the optic foramen, sphenoidal fissure, and ethmoids, producing orbital hematomata and exophthalmias.

The pterygo-maxillary fossa is relatively a ready means of communication between the contents of the orbit and the retromaxillary and jugular regions. According to Pascal's hydrostatic law and in the opinion of Dr. Félix Lagrange, which my own slight experience confirms, a missile penetrating into both the facial bony mass and soft parts will produce vibrations that are transmitted to the orbit by the pterygo-maxillary fissure, and a commotion in the orbit is produced. First the eye is proptosed, the optic nerve acting like a rubber band, and if the force of the missile is great a rupture of the posterior part of the globe may take place or an avulsion of the nerve. What applies to this region can also affect important structures in the retromaxillary and jugular regions.

In order to understand the clinical pictures produced by wounds of the orbit we must recall to our minds the structures that enter it, and in war wounds we find many interesting puzzles. A sort of composite picture resolving itself into various injuries of brain, bone, nerve, and blood vessels is produced, and there are often added symptoms of many degrees and all kinds of infections. They are fantastic lesions comparable to a cross-word puzzle whose solution can be solved only by a thorough knowledge of the anatomy of the orbit.

Surrounding the orbit are three important foramina; namely, the supraorbital, infraorbital, and foramen for the malar nerve. Within the orbit are the optic foramen, the sphenoidal fissure, and communication with the pterygo-maxillary fossa. If we reflect upon the important structures that go through these foramina and understand their function the complex puzzle is solved. However, consideration of the minute anatomy, cannot be entered into in a treatise of this kind.

As to missiles in general, the machine-gun bullet very seldom is found in the skull. It usually kills the individual at once, or, passing entirely through the structure, leads to one of those indelible pictures which I have previously mentioned. The most frequent foreign body met with in the head, in my experience, is the irregular shell fragment. Because of its jagged contour this fragment of the high-explosive shell meets considerable resistance and produces terrible deformities. The missile next most fre-

quently encountered and likely to remain in the skull is the shrapnel ball. From an entirely military point of view this means of destruction seems to me to be obsolete. I would venture to predict that fragments of the high-explosive shell, machine-gun bullets, and the effects of gas will be the concern of the future surgeons in war. The entrance and exit of the bullet are of interest. At the wound of entrance in the skull we usually find an exostosis, while the spent bullet produces at the aperture of exit a depressed excavation of the underlying tissues, for it usually takes with it some of the bony structure upon exit. In other words, there is produced a knifelike entrance; but on exit, because of malposition or malformation, the bullet becomes similar to a shell fragment, causing a wound of exit that simulates the entrance wound of a high-explosive shell. Of course if the bullet is travelling with high velocity and is fired at close range a clean through-and-through wound is usually produced.

Dr. Félix Lagrange from his vast experience has corrected and correlated many ophthalmic lesions that are of interest to the Army surgeons. He found that certain fundus lesions are produced by concussion and states that there is a distinct relationship between ocular lesions and disorders produced by foreign bodies in the facial bony structures. In other words "the same disorders of bones correspond always to identical lesions in the eye." As a consequence he formulated certain laws, based on clinical evidence, to which the interested reader would do well to refer.[1, 2] Briefly they are as follows:

(1) The concussion of air by an explosion can cause lacerations of the uveal tract, especially at the posterior pole. Luxation, subluxation of the lens, and traumatic cataract are definite and well-known pathologic entities of this injury.

(2) When the missile passes above the orbit, injuring the frontal bone and the anterior cerebral region, it produces fractures of the orbital vault at the level of the optic foramen and sphenoidal fissure, causing disorders in the sensory, motor, and optic nerves without injury to the eyeball.

(3) When the missile travels through the face below the eyeball, without going through the orbit and without fracturing it, it produces lesions by concussion, affecting the eye in the region of the macula. This is the most frequent cause of loss of acuity of central vision.

(4) When the missile has fractured the orbit, partially crushing in the wall without injuring the eyeball, there are produced in the eyeball serious concussion injuries, macular lesions, and choroidal ruptures. Macular lesions occur irrespective of the wall damaged. There also exist peripheral lesions always seated in front of the orbital wall that has been injured by the missile. Probably the orbital wall is fractured, at the same time, raised, and thrust on the eyeball, producing a lesion by contact; but whether the contact exists or not we have always observed that the peripheral lesion of the inner membranes is always situated in front of the fracture.

(5) When the projectile passes through the orbit, the eyeball not being involved, the same disorders are produced together with those which result from the lacerations of the organs contained in the orbital cavity; the optic nerve is often severed; and the papilla is lacerated as if torn away (avulsion of the optic nerve).

(6) When the missile grazes the eyeball tangentially without rupturing it, or when the globe is contused by the orbital wall being driven in upon it, there arise immediate disorders in front of the contused spot (choroidoretinal lacerations with retinal detachment and proliferating retinitis); the macular region is often involved in the damage but it is not injured alone.

In discussing the first group of cases Lagrange points out that the lesions are induced by a column of air agitating the ocular wall, producing lesions at the posterior pole. He states that lesions by concussion are situated in the uveal tract, and that in any violent concussion of the eyeball this tract gives way first, inducing a choroidal rupture or concussion lesion. A rupture of both the choroid and retina (this is important) produces lesions by contact, and in the end a traumatic proliferating choroidoretinitis, not a retinovitreous proliferation. We have seen a number of such cases of contact injury.

I have very vivid recollections of two concussion lesions. After the Armistice it was the custom of the men to sneak out over the "playgrounds" and bring back various souvenirs to Paris. Once, while unloading a shell, it exploded, killing a number and sending four or five wounded to our hospital. Two of the men, while wounded in the chest, had no wounds of the face; yet there were typical concussion choroidal lesions at the macula, the lens showing no evidence of injury.

The visual disturbances in the second group of cases are self-explanatory, but in most of our cases optic atrophy was often associated with other nerve lesions.

In the third category the lesions are injuries received by a missile at a distance, producing macular lesions due to the transmission of vibratory concussions to the orbit through the medium of the pterygo-maxillar fossa and fissure. The situation of these lesions at the posterior pole is due to the delicate structure of the macula and the attachment of the optic nerve.

The fourth group of facts needs little explanation. We have a macular lesion and a choroidal and retinal lesion in front of the fractured orbital wall. We observed in these cases of choroidal and retinal rupture the typical picture of a traumatic proliferating choroidoretinitis.

In the fifth group of facts, in addition to the lacerations of the organs in the orbital cavity there is often to be found the classical picture of partial or total avulsion of the optic nerve that I shall discuss in detail later.

In the sixth group of facts we find lesions produced by bullets that are represented by ruptures of the choroid and retina, caused by a missile grazing the eyeball without rupturing it, inducing from the contused spot in the eyeball lacerations especially toward the posterior pole. In this class of cases, we have a typical picture of traumatic proliferating choroidoretinitis; the end result of a double laceration of the choroid and retina.

If we compare tumors to shell fragments, and in a way consider infective processes or toxic disturbances somewhat similar to hemorrhagic processes produced by missiles, we believe that neurologists and brain surgeons will readily realize that the lesions of war injuries and peace-time pathologic processes are somewhat akin. In our experience there is decidedly a more rapid clearing of intraocular hemorrhages due to injuries than in those of nontraumatic origin. We have also seen some detachments of the retina caused by trauma reattach by merely rest in bed, as the classical operations for detachment were not in vogue at the time of the first World War.

In civilian ophthalmic practice we are not inclined to be so fastidious in regard to the neurologic examination around the orbit, but in military ophthalmic examination, all injuries of the eyeball should be considered as coincident to orbital injuries, and these in the great majority of cases leave definite neurologic lesions such as anesthesia, hyperesthesia, and muscle spasm, their location being determined by the pathology produced in the structures involved.

In any injury of the eye or orbit I would suggest the following routine method of examination.

1. (a) Examination of skin around the orbit for areas of anesthesia or hyperesthesia. (b) Look for spasm or paralysis of facial or ocular muscles.
2. (a) Palpation. Determine if there is cerebral pulsation; (b) loss of bone substance; (c) exostosis.
3. (a) See if there exists exophthalmos or anophthalmos; (b) bruit.

4. (a) External examination of the lids and lacrimal sac. (b) Examination of orbital margin for malformations or loss of tissue. Inspection for infected sinus (other than those coming from the ordinary sinus of the skull).
5. Examination of media, cornea (sensitivity), lens, vitreous, and fundi.
6. Determination of vision; charting of fields; mapping out blind spot; charting scotomas; testing color vision.
7. Testing the muscle balance.
8. Auscultation. (a) Bruit. (b) Vocal resonance. Compare the sound of the spoken voice of the patient when a stethoscope is placed directly over the closed eyeball of the injured eye with that of the uninjured eye with a stethoscope similarly placed. In our experience sometimes orbital complications such as the presence of a missile may increase the vocal resonance when tested in this manner.
9. Nasal examination; careful examination especially for intranasal adhesions.
10. Mouth and oral examinations.
11. X-ray. Determine the exact location of the foreign body. When this refinement is not at hand we have to resort to
12. Probing. This procedure to my mind is very important, and eliminates in a great majority of cases the necessity of a Krönlein operation for the removal of shell fragments.
13. Complete neurologic examination and fluoroscopy of the entire body.

Five unusual conditions are found in war surgery that are comparatively rare in civilian practice: 1. Traumatic proliferating choroidoretinitis of Lagrange. 2. Spastic entropion (blepharospasm). 3. Avulsion of the optic nerve. 4. Enophthalmos (true and false). 5. Hematic pigment ring of the disc.

TRAUMATIC PROLIFERATING CHOROIDORETINITIS OF LAGRANGE

This condition is produced by a missile's striking the wall of the orbit, fracturing it, or by its striking a glancing blow of the eyeball without rupturing it. Such an injury produces waves of force that are transmitted through the orbital fat, resulting in a concussion of the eyeball. Secondarily, there is produced a rupture of the uveal tract resulting in hemorrhages involving the choroid, retina, and possibly the retinovitreous spaces. The site of the lesion is not retino-vitreous, as so often occurs in young individuals with recurring hemorrhages. The terminal picture is a connective-tissue proliferation with the formation of fibrous tracts, the choroid being the productive factor in this unique lesion.

SPASTIC ENTROPIN BLEPHAROSPASM

This condition often comes on after postoperative convalescence and is induced by irritation or traumatism to the infraorbital nerve. It is usually caused by a foreign body situated behind the eyeball near the apex of the orbit. Sir Herbert Parsons has advocated, and reported successes by, resecting the nerve in the orbit. The following operations was performed by me in France for a spastic entropion of the lower lid and I have used it subsequently in ordinary routine practice with excellent results.

Operation for spastic entropion of lower lid. The eyeball is anesthetized and the hard rubber plate, lubricated with sterile vaseline, is introduced under the lower lid. The ordinary injection of no-

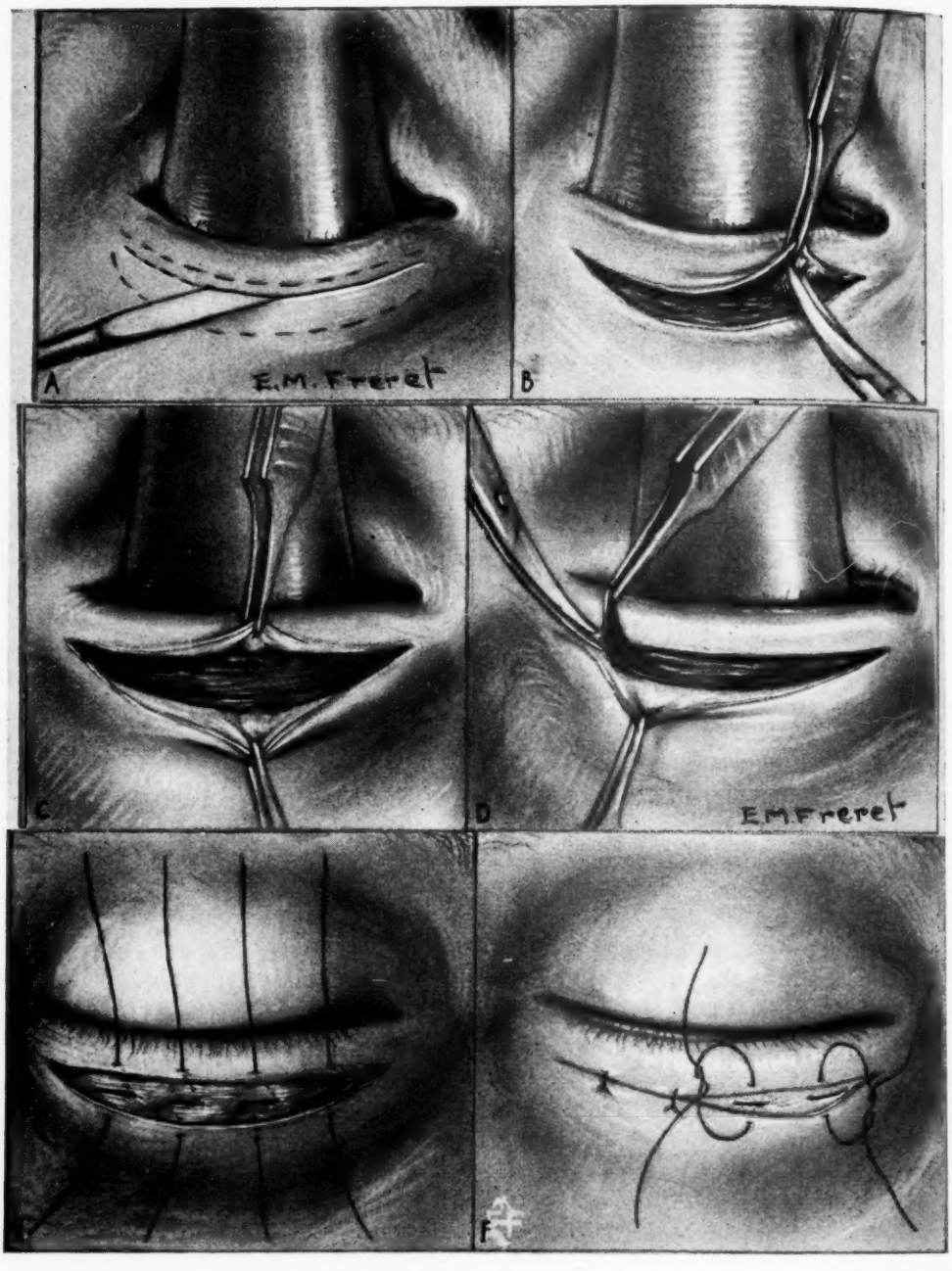


Fig. 1 (Doherty). A and B, incision; C, demonstrating the muscle to be dissected; D, excision of the orbicularis; E, method of introducing sutures; F, closure of wound.

vocaine infiltration is used, for this gives more bulk to the muscle and makes the dissection easier and more accurate (fig. 1 A). Next an incision is made in the skin of the lid, 4 mm. from the lid margin, and the length of the palpebral fissure. The second somewhat crescent-shaped incision joins the first, the larg-

est width of the crescent being 3 mm. (fig. 1 B). The skin is dissected free and the exposed fibers of the orbicularis are shown (fig. 1 C). This drawing depicts the muscle that is to be dissected. Figure 1 D shows the method of dissection. Figure 1 E illustrates the manner in which the sutures are introduced. They are first placed in the skin of the upper incision and then in a horizontal direction in the tarso-orbital fascia, grasping, if possible, some of the tarsus. This bite should bisect the entrance and exit of the suture. Figure 1 F shows the wound closure.

AVULSION OF THE NERVE

This ophthalmoscopic picture is rare in civilian practice but occurs in the majority of cases of suicide. During my service I saw a complete avulsion of the optic nerve in both eyes caused by a machine-gun bullet, and I am positive the patient did not die of this injury. In an injury that produces an avulsion of the optic nerve there is a profuse hemorrhage which rapidly absorbs. The disc appears white and blurred, often excavated, and is usually surrounded by the characteristic traumatic proliferating choroidoretinitis or fibrous plaque. This may completely or partially fill the excavation. In the latter case we are in all probability dealing with an incomplete avulsion of the nerve. The picture somewhat simulates a congenital coloboma of the disc, but in avulsion of the nerve the blood vessels are characteristic, appearing often completely devoid of blood and resembling long white cords. The fibrous plaque is also distinctive of this condition. In my cases it had a dull white appearance, with a seagreen sheen which in all probability was due to the blood pigment. As the condition progresses the plaque becomes a dull white. This mass lies in a simple relation of propinquity with the vitreous body. It projects only moderately, usually en masse, and is totally unlike the ordinary retinitis proliferans due to organization of effused blood whose membrane is translucent, the projections ending free in the vitreous. In traumatic proliferating choroidoretinitis secondary retinal detachment does not occur, and in fact produces adhesions that very closely cement the choroid and retina.

ENOPHTHALMOS, TRUE AND FALSE

True enophthalmos should be designated as a retraction of the globe due to injuries sustained by trophic disturbances.

False enophthalmos depends upon a depression of one of the walls of the orbit, producing an enlargement of the orbital cavity, and a secondary pushing-in of the eyeball. In the early days of injury the eyeball may have a rather marked exophthalmos due to retrobulbar hemorrhage, but after a few weeks the patient usually complains of ptosis; false ptosis due to faulty support of the upper lid by the eyeball and limitation in the ocular movements.

HEMATIC PIGMENT RING OF DISC

These are produced by hematomata of the sheaths of the optic nerve, and the ring is created as an end result by the slow migration of the hematic pigment. The first symptom is usually a semi-annular paracentral scotoma, which is followed by a blackish-red pigmentation around the scleral ring. Both scotoma and pigment ring sometimes have a tendency to clear up.

A few of the interesting cases that we have encountered are reported herewith.

Case 1. Figure 2. The following autopsy report needs very little explanation. Only relative data are given:

Autopsy No. 126. American Expeditionary Force.
American Red Cross Military Hospital No. 2. Col. Joseph Blake Commanding.
Name: L——, P.G. *Rank:* Private
Organization: F Co., 30th Engineers *Age:* 21 *Race:* White
Date of death: 19 Dec. 1918, 3 p.m. *Place of death:* A.R.C.M.H. No. 2
Date of autopsy: 19 Dec. 1918, 4 p.m. *Place of autopsy:* -do-
Pathologist: 1st Lieut. H. W. Hundling, M.C.

Clinical data: The patient was wounded on November 1, 1918, receiving a compound comminuted fracture of the left fronto-parietal bones. He was admitted to A.R.C.M.H. No. 2 on November 18th. On November 13th a piece of high-explosive shell had been removed from the posterior portion of the left orbit. The skull was badly fractured and the fragments were united by wire. On December 17th spinal puncture revealed the presence of pneumococci, which proved to be of the type-II group.

Left Right

Fig. 2 (Doherty). Case 1. Piece of high explosive shell can be made out and wire uniting fragments. Area of bone loss can also be seen.

External appearances: Body of a moderately well-developed, well nourished, white American soldier. Body heat is still present, and post-mortem lividity practically absent. There is a recent lumbar puncture wound. Over the left fronto-parietal region is a partially healed, markedly depressed wound. The depression extends through the supra-orbital ridge at the outer margin. There is slight bulging of the eye. This depression extends into the structures for a distance of 1.5 cm. There is no discharge from the wound, which is partially covered by a blood crust.

Head: On removing the calvarium a large trephine opening in the left fronto-parietal region was seen, the bone in the region of the supra-orbital ridge being badly comminuted. The dura was adherent to the bone about the depressed opening. A very small opening was found in the dura immediately beneath the portion of the wound covered by crusted blood. On removing the dura it was found that the entire anterior portion of the left frontal lobe was occupied by a huge, greenish gray, pus-containing abscess. The entire superior surface of the brain, and also, to a less extent, the base, were lightly coated with a similar deposit. The brain tissue immediately beneath this abscess was rather soft. On section the ventricles were comparatively clean. At the center of the superior surface of the right parietal lobe there was a small abscess about the size of a hazel nut. On examination of the base of the brain it was found that the left orbital plate was badly comminuted, portions of the bone causing pressure on the posterior portion of the eyeball. There was no pus, however, in this orbital cavity. The sinuses were apparently normal.

Probable cause of death: Old gun-shot wound of the left fronto-parietal region; solitary brain abscess; meningitis; broncho-pneumonia.

The left eye was blind and presented the typical picture of avulsion of the optic nerve. At the posterior pole there was a large greenish-white plaque. Along the nasal side of the plaque was what appeared to be the remains of the disc. This had the appearance of a pearl-white crescent peeping out from the side of the mass, but at a lower level. Two blood vessels could be distinguished. One partially filled with blood was going toward the superior nasal quadrant of the fundus

and the other appeared as a long white cord traversing the lower nasal quadrant. There were pigmentary patches surrounding the plaque, some of which extended to the ora serrata. The right eye presented the typical picture of choked disc. I do not have the records of the perimetric examination. The missile was removed by an incision made over the rim of the orbit; the orbital fascia was opened, and a probe was introduced. The foreign

Fig. 3 (Doherty). Case 2, front view. From the New York Eye and Ear Infirmary.

body was readily felt and removed with a pair of bullet forceps. I have removed smaller missiles situated in the anterior and posterior ethmoids after the alae nasi had been reflected by an incision along the nasal cheek groove. This operation gives a beautiful view of the interior of the nose and was practiced on difficult submucous resections in the clinics of Paris during the first World War. With careful suturing there is practically no deformity of the alae.

Case 2. Figures 3, 4, and 5. While this

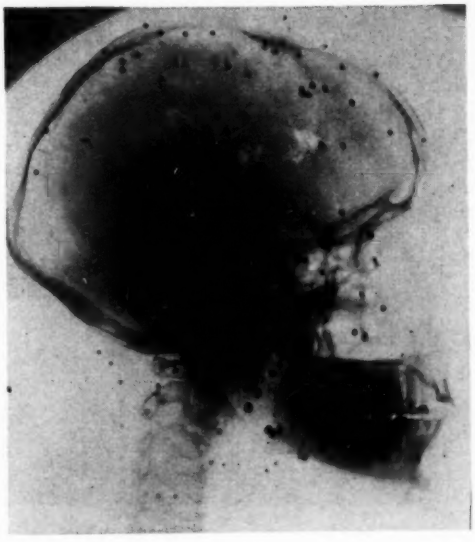


Fig. 4 (Doherty). X-ray, lateral view, case 2. From the New York Eye and Ear Infirmary.

was not a case of war injury I feel justified in reporting it. The patient, J. M., was wounded with a shotgun in October, 1926. He was first examined by me one

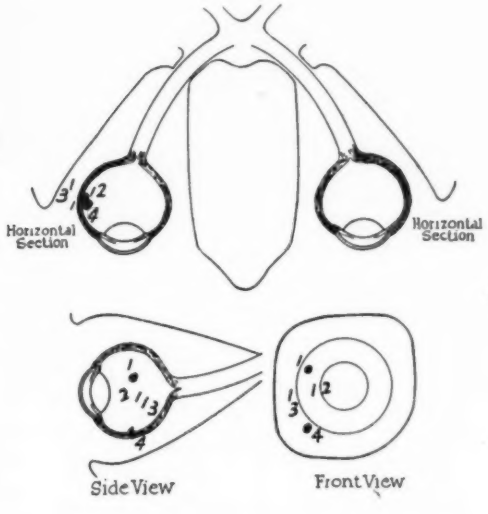


Fig. 5 (Doherty). Case 2. X-ray charting of foreign bodies. From the New York Eye and Ear Infirmary. One hundred twenty-nine shot counted in right side of head, face, and neck. Two foreign bodies in globe and two in orbit of right eye.

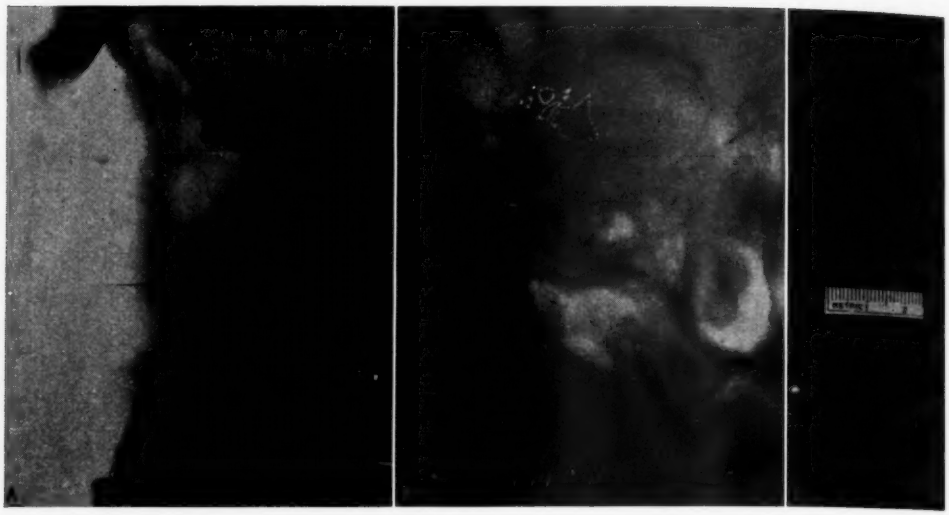


Fig. 6 (Doherty). Case 3. A, X ray, lateral view, showing foreign body (bullet); B, front view; C, remnant of bone found in eyeball. From the New York Eye and Ear Infirmary.

year later. The eye was quiet; there was a traumatic cataract, and the light projection was faulty. He had been told there was no foreign body in his eye but that the optic nerve was injured. A careful localization by Dr. George S. Dixon of the New York Eye and Ear Infirmary proved this to be false (see fig. 5). The following X-ray report was returned. "One hundred and twenty-nine bird shot were counted in the right side of his head, face, and neck, but only one shot and one fragment were located in the globe of the right eye, numbers 1 and 2. Numbers 3 and 4 are in the orbit." The patient refused any operative interference at this time. Four years after his original injury the right eye became red and painful, and he again consulted me. Examination showed a large hemorrhage in the anterior chamber; an iris bombé attached to the anterior capsule of the lens; the lens to be cataractous, and the eye soft and shrinking. The X-ray examination confirmed the existence of the foreign bodies, and because of the danger of sympathetic ophthalmia the eye was enucleated. This case certainly stresses the need of careful localization in injured eyes when there is a suspicion of an intraocular foreign body.

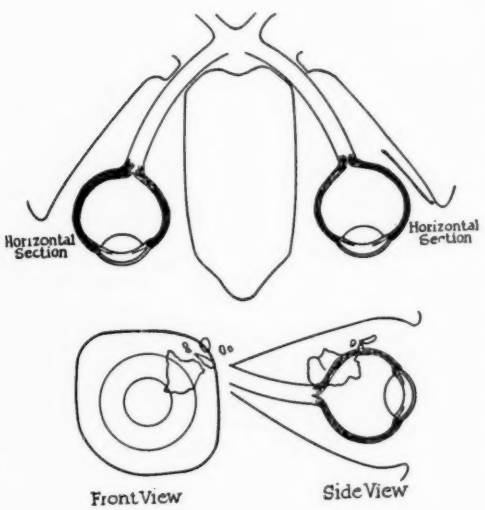


Fig. 7 (Doherty). Case 3. X-ray charting of foreign bodies. One large and six small pieces located in a square 12.5 by 17.5 mm. From the New York Eye and Ear Infirmary.

Case 3. Figures 6 and 7. In 1924 the patient, J. L., while engaged as an agent of the Federal Government, was shot from ambush. The bullet entered the skull just above the orbital ridge of the frontal

bone on the left side. He was taken to the home of a physician who rendered first aid, and was later removed to New York. The X-ray examination showed the bullet to have flattened in the orbit, apparently without rupturing the eyeball. Four years later (1928) he consulted me. Examination disclosed a convergent strabismus with a traumatic cataract. The pupil reacted to light; the light projection was faulty, but the tension of the eye was normal. The patient complained of pain in the orbit, so I removed the largest piece of the bullet but was unable to find the smaller fragments. For cosmetic reasons an operation for squint was performed with an excellent result. One year after the operation I was again consulted. This time the eyeball presented marked evidence of iridocyclitis; the tension was minus, and I advised an enucleation. Following the removal of the eye a very extraordinary situation was found. A remnant of the bony part of the orbit was located inside the eyeball (fig. 6). The presence of this intraocular bony foreign body was not revealed by the X-ray but must have existed from the time of the accident; it could not be confused with the ossification of the choroid, as is clearly indicated in the illustration.

Fig. 8 (Doherty). Case 4. X ray showing machine-gun bullet in orbit. Lateral view.

FIG. 9 (Doherty). Case 5. X ray showing piece of high-explosive shell in apex of orbit.

Case 4. Figure 8. The patient was wounded during the Chateau-Thierry drive. There was a jagged perforation of the lower lid, but the eyeball certainly gave no indication of what had happened. Examination showed a slight exophthalmos with a marked ecchymosis of both upper and lower lids. There was a jagged perforation of the lower lid with some loss of tissue. On separating the lids the cornea appeared normal, and the anterior chamber was completely obliterated by the hyphema; the tension of the eyeball was minus, and there was no perception of light. The X-ray disclosed a machine-gun bullet which, ricocheting from the front, struck the lower rim of the orbit, producing a fracture, and penetrated the posterior part of the globe, where it remained embedded about half in the globe and half in the orbit. Needless to say the eye was enucleated and the machine-gun bullet extracted. This was one of the many freak cases that I encountered.

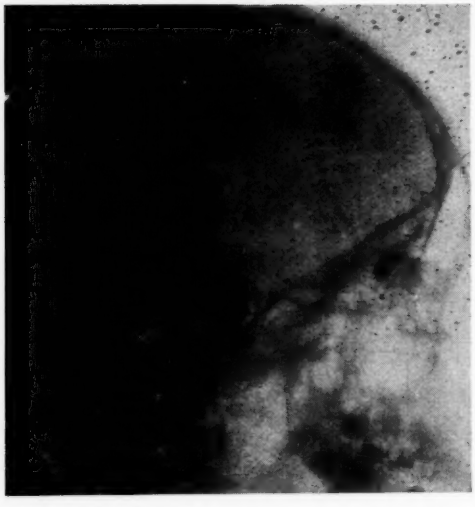


Fig. 10 (Doherty). Case 6. X ray showing position of piece of high-explosive shell.

Case 5. Figure 9. This case presented a partial avulsion of the optic nerve with ophthalmoplegia externa, later followed by neuroparalytic keratitis. The pathology was caused by a piece of high-explosive shell which entered just behind the superior external angle of the orbital opening. It literally plugged the apex of the orbit. With a probe the tract of the missile could be traced. The foreign body was extracted.

Case 6. Figure 10. The missile in this case entered the skull just below the eyelid, producing a fracture of the left inferior external orbital wall. It penetrated the orbit from below upward and was removed in the region of the lacrimal gland. The fundus presented macular and peripapillary choroidoretinitis (concussion lesions).

Case 7. Figure 11. A small particle of high-explosive shell produced a fracture of the frontal sinus on the right side. It passed along the internal wall of the right orbit, traversed the superior maxilla and roof of the mouth, and finally lodged in a lateral part of the neck. Vision was 20/20, and there were no fundus lesions. Needless to say the shell splinter was not removed, and my last record showed a discharging fistula from the frontal sinus.

Case 8. In 1918, the patient, F. D., was plowing on one of the battlefields in Italy when his plow struck a shell, causing it to explode. He felt a stinging sensation in his right eye, but the only treatment he gave the eye was to bathe it in boric-acid solution. The eye remained red for a few weeks and then seemed to quiet down. During the 13 years following the accident he had a number of attacks of redness, pain, lacrimation, and photophobia, lasting from four days to several weeks, but received very little medical attention. He came to the New York Eye and Ear Infirmary for an examination because of a diminution of vi-

Fig. 11 (Doherty). Case 7. X ray showing small particle of high-explosive shell lodged in lateral part of neck.

sion in the right eye and wished to learn if glasses would improve his vision, which was reduced to 20/200. This reduction of vision was due to organized exudate on the anterior capsule of the lens secondary to previous attacks of iritis. A careful examination of the iris with a slit-lamp revealed a small nodule, tubercular in appearance, situated in the iris at the 7-o'clock position. There was no evidence of siderosis but because of the history of an accident an X-ray examination was made, which showed the nodule to be a small encapsulated foreign body. It was not magnetic, so the anterior chamber of the eye was opened with a keratome, the nodule grasped with iris forceps, and removed through a small iridectomy opening.

This case emphasizes the fact that many of the so-called red or inflamed eyes that have been treated for various types of inflammation sometimes prove to contain foreign material that has existed for years, its presence finally detected only by special technique with careful X-ray examination.

Much discussion has been devoted to the question of the tolerance of the eye to various kinds of intraocular foreign material. The preservation of a useful eyeball under such conditions does not depend upon the actual invasion of microorganisms but upon both chemical decomposition of the substance and mechanical irritation. All aseptic foreign bodies after a time decompose or become encapsulated, and their presence within an eye will ultimately lead to its destruction or produce a marked loss of visual acuity. Certain tissues of the eye will react differently to foreign bodies. The iris and ciliary body usually react more seriously to injury than does the lens or vitreous, and certain substances seem to be more of an irritant than others. Copper usually induces violent inflammatory reactions; iron if not encapsulated forms an oxide that causes a discoloration. Wood, lead, or other foreign material that is not magnetic is always of a more serious character because the extraction of such substances obviously involves more trauma and manipulation than does a magnetic foreign body that can be extracted by means of an electromagnet.

The appearance of an injured eye gives no clue as to the absence or presence of a foreign body; it is only by careful examination by means of the X ray that we can make a positive diagnosis. A positive diagnosis of a foreign body by means of the X ray is not sufficient; an accurate plotting to determine the size and position of the missile must be made in order to insure a successful attempt at its removal.

In general we find concussion lesions in or around the macula manifested by hemorrhages, lacerations of the choroid, and also choroidoretinal ruptures. A concussion in contact lesion may coexist. The following case is illustrative of such an occurrence.

Case 9. Figure 12. R. G., male, aged 19 years, stated that on September 13, 1941, while using a mop wringer, the spring flew from the bucket and struck him in the left eye. Examination showed a very small superficial wound of the skin of the lower lid. There were no other signs of injury to the lids, conjunctiva, cornea, or iris. The iris was partially dilated but did react sluggishly to light; the lens was clear; the vitreous showed no pathologic involvement.

The fundus, which could be plainly seen, presented a rather unusual classical picture: There was an intense edema with a marked cherry-red spot (fig. 12 A). The disc presented no abnormality nor were there any vascular changes. In the pe-

riphery below appeared what could be described as a "blood blister." The upper part of the blister contained what resembled a yellowish fluid. This is the typical early picture of traumatic proliferating chorioretinitis (contact lesion) due to ocular concussion by contact, inducing secondarily a rupture of the uveal tract and retina. In the macula there was a typical early concussion lesion. Figure 12 B shows the same condition 11 days after the injury. The rapid organization of the extravasated blood in the contact lesion below with the ultimate formation of a dense fibrous plaque is readily observable. The edema in the macula has cleared, and this area now presents a hole in the macula toward the nasal side of the choroidal rupture. There is a central absolute scotoma.

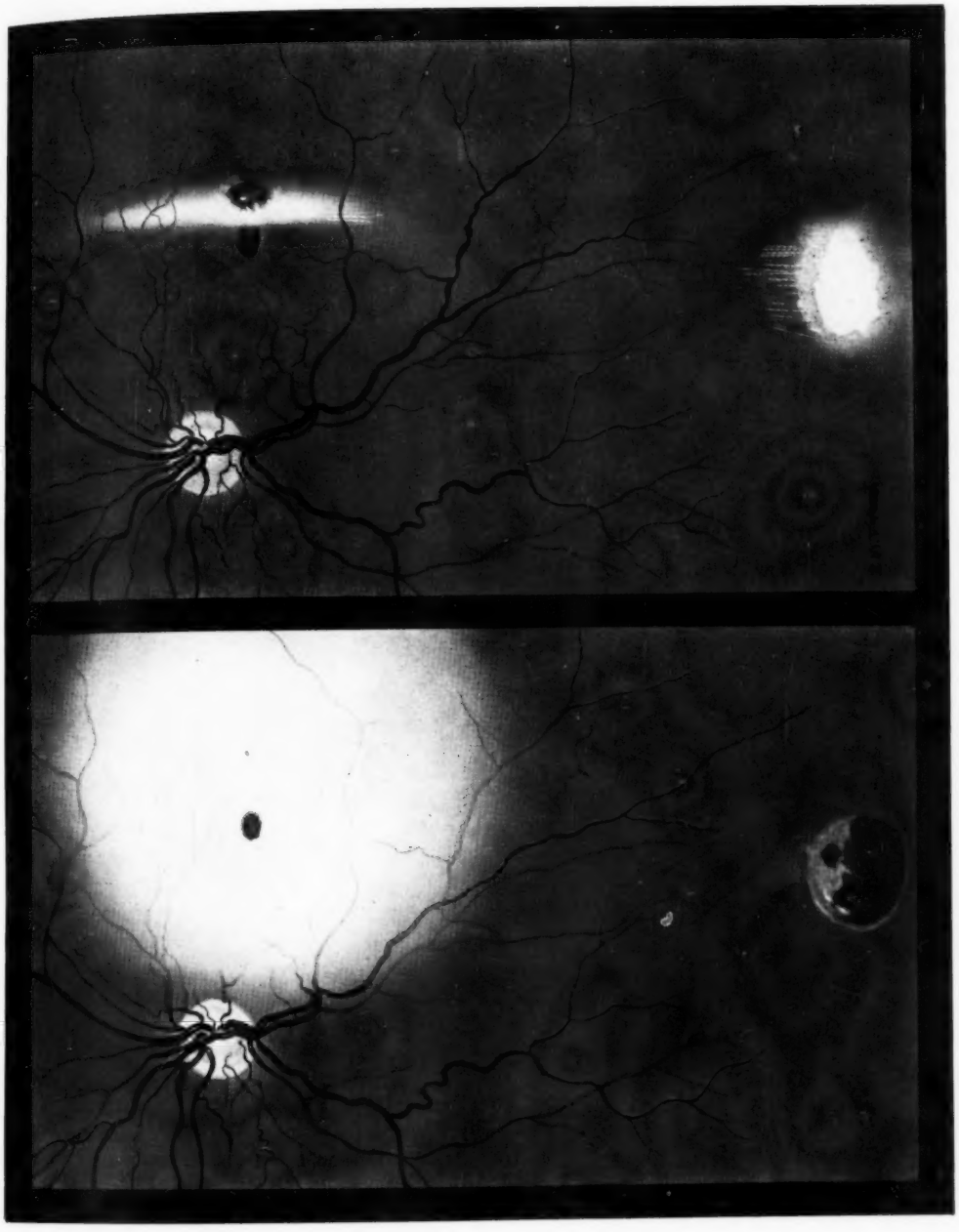
An interesting observation made by Lagrange is that "fractures of the cranium by projectiles of war, implicating the cranial vault, at a distance from the orbit, even when they are accompanied by large losses of substance and in consequence by well-marked concussion, do not give rise to fracture by contre-coup of the vault of the orbit. Contrary to what is taught in the classical literature the sphenoidal fissure, the optic foramen, and the structures that pass through them remain unharmed after such traumatism. In military surgery fractures of the orbital vault are direct fractures."

In wounds of the orbit (fig. 13) certain procedures should be carried out. Any immediate wound of the orbit or surrounding structures usually produces marked swelling, ecchymosis, and profuse intraorbital hemorrhage so that secondarily there is often found a very marked exophthalmos. In the first-aid station after the ordinary attentions of asepsis are carried out—that is, flushing the wounds with hydrogen peroxide, applications of

Fig. 13 (Doherty). Types of orbital fractures.

tincture of iodine, and the injection of antitetanic serum—the attention of the surgeon naturally turns to the eye. I used the word *surgeon* because an ophthalmologist in a first-aid station is out of place. Many sad recollections come to my mind pointing to the fact that if a few important fundamentals had been made known to the general surgeon many deformities of the lids and orbit would have been greatly lessened and many eyes saved by the best possible first-aid treatment under exceedingly trying conditions.

In marked cases of exophthalmos, in order to protect the cornea, bichloride ointment 1:3,000 should be instilled in the cul-de-sac, then the lids should be sutured together in the quickest and easiest way, placing the sutures so that they are not directly over the cornea, and applying an appropriate dressing. At the front speed is very necessary, and no surgeon can or should try to produce the classical picture seen in the well-equipped hospital. In fact no restorative work of any kind should be attempted until two to four weeks have elapsed. This statement also applies in the removal of bullets. A surgeon in the first-aid station should be warned against probing for bullets. He should be cautioned against removing any tissue and above all he should never remove any fragments of bone found



A B

FIG. 12 (DOHERTY). A. FUNDUS AS IT APPEARED 24 HOURS AFTER THE ACCIDENT; B. THE FUNDUS 11 DAYS AFTER THE PRIMARY INJURY.

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around the orbital margin. His work after rendering first aid should consist of placing the mutilated parts back in as good position as possible and then put on a snug supporting dressing for transportation to the rear. Even if the globe is hopelessly injured any eyeball can be more skillfully enucleated after the ecchymosis and swelling have subsided, and I believe there is very little danger of sympathetic ophthalmia in allowing any mutilated eyeball to remain in the socket for two weeks.

In briefly discussing reparative surgery due to loss of substance of the orbital margins, three materials have been successfully used. First, cartilaginous grafts; second, adipose grafts; third, metallic plates. Cartilaginous grafts, so far, have proved their worth, and many operators have reported brilliant results. Adipose grafts have also been successfully used, especially in filling up marked depressions. There is now, however, an alloy, vitallium, that is beginning to be extensively used by plastic surgeons for restorations. In my opinion, because vitallium lies inert in the body tissue, molds of this alloy would give beautiful results in this particular type of work. I am inclined to believe that this cobalt chromium alloy has been somewhat overlooked by the plastic surgeons and has not been given the place it properly deserves in this very specialized branch of surgery.

Cases and photographs were obtained while in the service in the A.E.F. as Captain in the Medical Corps, United States Army; attending ophthalmologist at Colonel Blake's Hospital, Paris, France.

I wish to thank the White Studio of New York City for the photographs of the X-ray plates.

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A STUDY OF AQUEOUS HUMOR AS AN AID TO UNDERSTANDING UVEITIS AND CERTAIN RELATED CONDITIONS*

I. A PRELIMINARY REPORT

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The introduction of the exact methods of physics and chemistry into the field of microbiology, and the adoption of a corresponding mental attitude are apparently necessary to the further understanding of uveitis and related conditions. In a previous paper on this subject,[1] we drew attention to the fact that an etiologic diagnosis of uveitis cannot be made from the clinical appearance of the eye, and suggested that study of the aqueous, like that of cerebrospinal fluid, may come to have diagnostic significance. The present report includes the 20 cases from the earlier paper and 24 additional ones, together with a report on findings in experimentally produced sclerokeratitis in rabbits.

At the outset we were interested in determining some finding or combination of findings that might further establish the etiologic diagnosis. We made various determinations on the aqueous in different cases of uveitis, keratitis, glaucoma, and retinal disease, as circumstances allowed. The amount of aqueous available is extremely small, and only a limited number of tests could be made on a single fluid. As indiscriminate aspiration of aqueous simply for collection of data might be unwise, correlated findings are lacking and will be forthcoming only after data on a large series of cases are available. The work to date has increased our understanding of the slitlamp picture of the anterior segment in relation to the composition of the aqueous in such a way as to be of practical importance, and to suggest further fields for observation.

* From the Department of Surgery of the University of Southern California School of Medicine. Read before the Pacific Coast Oto-Ophthalmological Society at Spokane, Washington, June, 1940.

METHODS

Before analyzing the data reported, the methods used for obtaining and analyzing the aqueous will be described; for the procedure of aspiration and analysis of aqueous is not generally carried out and in some respects is entirely original.

The aqueous is obtained after routine preparation as for intraocular surgery and topical anesthesia with 0.5-percent pontocaine. In addition, in acute, painfully congested eyes a Van Lint block is used, and 2-percent novocaine or a solution composed of equal parts of 4-percent cocaine HCl and adrenalin 1:1,000 (often used for breaking up adhesions in iritis) is injected subconjunctivally. The limbus is grasped with an Elschnig forceps at the 8-o'clock position, and opposite this, at about the 3-o'clock position, a small discission needle is inserted into the cornea, about 1 mm. from the limbus, until the point can be seen just entering the anterior chamber. The needle-knife is then withdrawn and a 27-gauge needle, attached to a dry-sterilized tuberculin syringe, is inserted through this opening on into the anterior chamber, lying parallel to the iris. An assistant draws out the plunger very gradually while the operator watches the chamber flatten. When the needle is about to come in contact with the iris, it is withdrawn. We have obtained from 0.15 to 0.45 c.c. of aqueous, the average amount being 0.24 c.c. We attempt to enter with the needle over the iris as additional protection to the lens,

and the aqueous from the bottom of the chamber is preferred because of sedimentation of cells in this area. A purely corneal puncture is made because there is less chance of contamination, and we found it easier to penetrate at this point than at the limbus. It is not wise to use a small needle alone for penetration, especially in soft eyes, and the preferred technique of using a needle-knife first does not waste fluid, as the elasticity of the cornea closes the wound when the needle-knife is withdrawn. Use of a binocular loupe and good light facilitates the operation. After withdrawing the needle-knife the operator should not take his eyes from the point of entry or difficulty will be encountered in reëntering the incision. If properly carried out the procedure amounts to no more than a therapeutic paracentesis. In our experience this method was most satisfactory and is practically the same as that used by Selinger[2] in 1934.

A drop of fluid is placed on a slide for cell differentiation. The remaining fluid for chemical analysis is immediately transferred to a weighing bottle. The last remaining drop in the needle is placed on another slide for differential cell count. This gives samples for cell study from the first and last fluid aspirated. The amount of fluid in the weighing bottle is determined by weight and a specific gravity of 1.008 is assumed for the calculation of results in mg./100 c.c.

Wright's stain is used for the differential count. We found that cell differentiation was more difficult than had been anticipated, and only after our experience with the aqueous of rabbits did we feel reasonably certain of the cell differentiation. Generally the number of cells was so small that smearing out a drop for quick drying, as is done with a blood smear, left too few cells on the slide to make study reasonable. Consequently we allowed a drop to dry at room temperature without spreading it out. This slow drying undoubtedly caused shrinkage of the protoplasm, especially of the polymorphonuclear cells, so that they could be differentiated only by study of the nucleus, and even then the lobes tended to come together and might be mistaken for lymphocytes unless studied under oil immersion with exceptionally good light. In spite of a constant technique, one smear would sometimes be overstained, and another understained. Perhaps the difference in acidity of the fluids varied the staining results with Wright's stain. Many times it was found that the smear from the first drop showed an entirely different number of cells than a smear from the last drop of the same sample. This is quite possible when dealing with such a small amount of fluid, as a small fibrin strand may gather many cells, whereas another portion of fluid without fibrin clot would show relatively few cells. In some cases where, by slitlamp examination, the aqueous appeared to be loaded with cells yet smears showed only a few cells, we assumed that the protein clot already present in the anterior chamber had caught up the cells. The practice of taking the samples from the first and the last part of the fluid for the cell count lessens this discrepancy. Finally it should be noted that aqueous smears tend to wash off the slide more easily than do blood smears, and special precautions must be taken to avoid this. It is well, when there are few cells, to outline the drop on the slide with crayon.

Total protein is determined by the Denis-Ayer[3] method for quantitative determination of protein in the cerebrospinal fluid. All the fluid available, determined by weight, is diluted with water to 1 c.c., or, if a very high protein content is anticipated, to 2 c.c., and an equal amount of sulphosalicylic acid added. If

the turbidity is very slight, the unknown is set in the colorimeter so as to get the advantage of all the fluid in the tube, and the standard moved to match this.

The fluid was considered to contain fibrinogen if it clotted spontaneously within a few hours. Unless sugar determination was to be made, the fluid was set aside undisturbed for at least two hours to see if a clot would form.

Acetic-acid precipitation, according to Ropes,[4] is specific for mucin or mucoids. For qualitative test a drop of fluid was added to a drop of 2-percent acetic acid to make the final concentration about 1 percent.

Sugar is determined by microadaptation of the Folin-Wu[5] blood-sugar method. A measured volume of water, usually 1 c.c., is added to the aqueous immediately, even before weighing, to inhibit glycolysis.

Chlorides were not determined unless at least 0.2 c.c. of fluid was available. An adaptation of the method of Osterberg and Schmidt[6] was used. The importance of not contaminating the fluid, even with water left in the needle, warrants emphasis here. Using 0.2 c.c. of fluid, the limits of error of the method were ±15 mg. NaCl per 100 c.c.

Nonprotein nitrogen is determined by substracting from the total nitrogen, as determined by micro-Kjeldahl method, the protein nitrogen as determined from the total protein value.

Coincident samples of blood were taken when advisable for evaluation of the aqueous study.

ANIMAL EXPERIMENTS

The aforedescribed methods of examination of the aqueous were also used in the study of the rabbits' aqueous. An amount equal to 0.2 c.c. of fluid could be withdrawn easily from the anterior chamber of rabbits. Aqueous was withdrawn from the rabbits before they were prepared with tuberculosis. The latter procedure was accomplished by injecting 0.1 c.c. of a turbid emulsion of human tubercle bacilli into the groin. The immediate response was swelling of the adjacent glands, and within four weeks the rabbits were sensitive to 0.01 mg. tuberculin. At this time a second emulsion of human tubercle bacilli was injected at the limbus under the conjunc-

TABLE 1

SUGAR CONTENT OF THE AQUEOUS HUMOR

Case	Diagnosis	Etiology			Sugar		Total Protein	Cells		
		Wass.	O.T.	Foci	Blood	Aqueous		No.	Polys	Lymphs
									percent	
28	Iridocyclitis	Neg.	Neg.	Lenticular	78	39	3000	†††	25	75
11	Iritis	Pos.		Tonsils & Teeth	106	59	700	†	38	62
39	Hemorrhagic glaucoma			Diabetic	215	186	190	Rare	0	Very Rare
21	Iridocyclitis	Neg.	†	Sinusitis; Arthritis		40	1000	††	1	99
15	Iritis		Active Tbc.	Vit. Hem. in 1936		51	2500	††	50	50
17	Chronic iridocyclitis	Neg.	†	Negative		56	50	†	0	100
14	Iritis	Neg.	†	Arthritis		57	1535	††	8	92
35	Fuchs's dystrophy	Neg.	Neg.	Slight Arthritis		68	25	Rare		Rare
7	Iritis	Neg.	Neg.	Teeth & Tonsils		74	800	†	15	75
9	Iridocyclitis	Pos.	Neg.	? Gc.		75	480	†††	45	55
30	Iridocyclitis, interstitial keratitis	Pos.	Chest Neg.	None		82	50	†††	25	75
23	Posterior uveitis	Neg.	Neg.	Negative		88	10	†	4	96
32	Sclerokeratitis	Neg.	†	Negative; Tbc. Chest		88	25	†††	20	80
25	Lenticular iritis; glaucoma	Neg.	Neg.	Negative		88	720	Rare		Rare
33	Sclerokeratitis	Neg.	†	Negative		105	25	Rare	0	Rare
Rabbit 6 5/31	Normal		†		97	80	30	Rare	0	Rare
Rabbit 4 5/31	Tbc. Inject. Limbus 5/24		†			84	400	†††	29	71
Rabbit 2 5/31	Tbc. Inject. A.C. 5/24		†			66	1000	††††	65	35

tiva into the corneal stroma in rabbits No. 1, 3, 5, and 6, directly into the anterior chamber in rabbit No. 2, and into the center of the cornea in rabbit No. 4. Similar injections were made into the eyes of three rabbits not sensitized to tuberculin. The method used was suggested by the work of Woods.[7]

RESULTS

SUGAR

The sugar content of the aqueous is shown in Table 1.

It is seen from this table that there is little relation between the type of ocular inflammation and the sugar content of the aqueous. There is a definite correlation between the blood-sugar level and the aqueous sugar, as would be expected.[8] There seems to be a tendency toward a lower sugar content (under 55 mg. per 100 c.c.) in eyes with increased inflammation as judged by the number of cells, percentage of polymorphonuclear leucocytes, and increase in protein content. It is possible, although not evident from these data, that there may be eyes having a high total protein in the aqueous (as in separated retina and uveitis with glaucoma secondary to lens material escaping into the ocular fluids—"lenticular glaucoma") with relatively few cells and normal sugar, suggesting a relatively non-inflammatory process in contrast to inflammatory conditions with high protein, many cells, largely polymorphonuclear, and slightly reduced sugar content. A comparable reduction in sugar content is occasionally seen in cerebrospinal fluid from patients with an aseptic meningeal reaction. This reduction may possibly be explained by the presence of glycolytic ferments that have gained entrance to the fluid with the inflammatory reaction.

TABLE 2

CHLORIDE CONTENT OF AQUEOUS HUMOR AND BLOOD SERUM

Case	Diagnosis	Serum mg. NaCl/100 c.c.	Aqueous mg. NaCl/100 c.c.
31	Interstitial keratitis	614	817
29	Scleral keratitis	587	772
41	Glaucoma	650	718
36	Acute glaucoma	579	721
37	Acute congestive glaucoma	617	724
37	Acute congestive glaucoma	624	720
Rabbit 3	Normal	614	720
Average ratio Aqueous NaCl/Serum NaCl			1.21
Ratio Cerebrospinal fluid NaCl/Serum NaCl			1.22

CHLORIDES

In table 2 is recorded the chloride content of the aqueous humor and the blood serum.

The only conclusion from the chloride data of table 2 is that the ratio of aqueous to serum chloride, averaging 1.21, approximates that for cerebrospinal fluid to serum chloride, 1.22, according to Fremont-Smith,[8] as would be expected with two such relatively protein-free fluids. The few results we report, considering the limits of error of our method, show, as did those reported by Hodgson,[9] no significant change of this ratio in glaucoma.

TABLE 3

NONPROTEIN NITROGEN CONTENT OF AQUEOUS HUMOR

Case	Diagnosis	Serum mg. N.P.N. per 100 c.c.	Aqueous mg. N.P.N. per 100 c.c.
40	Closure Central Retinal Artery	24	14
Rabbit 1	Normal		33
Rabbit 7	Normal	25	
Rabbit 8	Normal	26	25*
Rabbit 9	Normal		25*

* Assuming total protein 25.

NONPROTEIN NITROGEN

We are including what data we have

TABLE 4

GENERAL CLINICAL SUMMARY AND AQUEOUS FINDINGS

No.	Age	Sex	Eye	Clinical Diagnosis	History				Probable Etiologic Factors							
					Present Illness		Previous Attacks	Average Duration	Wass.	Tuberculin	Foci	Arthritis	Miscellaneous	Congestion	Cells	K.P.
					to Aqueous	to End										
1	41	M	O.S.	Iritis	4 days	7 wks.	10	6 wks.	Neg.	Neg.	? Prostate	? Gc., Hip, Ankle, Knee	?Herpes cornea assoc. with P. I.	††	Neg.	0
			O.D.	Iritis	10 days	3 wks.	10	6 wks.	Neg.	Neg.	? Prostate	? Gc., Hip, Ankle, Knee	Sulfanilamide had no effect	††	Neg.	0
2	46	M	O.S.	Infected trephine	7 days	4 wks.	0					None	Infection from conjunctiva	†††	Neg.	0
3	36	M	O.S.	Iritis	42 days	8 wks.	2	4 wks.	Neg.		Old Gc., Tonsils	None	Well following Tonsillectomy	†††	Neg.	0
4	46	F	O.D.	Iritis	9 days	3 wks.	0		Neg.		Teeth	None		†††	Neg.	0
5	24	M	O.S.	Acute iritis	7 days	4 wks.	0		Neg.		Teeth	None	Gc. complement fixation neg.	†††	Neg.	No slit-la exam
6	35	M	O.D.	Iritis	5 days	Active	1	8 wks.	Neg.		Gc., Teeth	Gc.	Iritish and arthritis after Gc.	††	Neg.	0
7	15	F	O.D.	Iritis O. U.	12 days	6 mos.	0		Neg.	Neg.	Tonsils ? Teeth	None	Tonsillectomy	††	Neg.	0
8	20	M	O.S.	Iridocyclitis	21 days	6 wks.	0		Pos.				Chancre 1 yr. ago	††	Sl. dens	††
9	35	F	O.S.	Iridocyclitis O.U.	56 days	3 mos.	Recurrent	2 mos.	Pos.		Gc. Pelvis	None	Nose and Throat neg.	††	Neg.	
10	39	M	O.S.	Uveitis O. U.	14 days	Active	0		Pos.		Chancre 12 yrs. ago	None	1st Rx 4 mos. ago; Iritis 6 wks. post-Rx.	†††	Stud.	
11	43	M	O.D.	Iritis O. U.	5 days	3 wks.	1	2 wks.	Pos.		Tonsils, Teeth	None	Teeth removed	†††	Clr.	0
12	30	M	O.S.	Iritis and Sclerokeratitis O. U.	4 days	6 wks.	5	6 wks.	Neg.	†	Teeth, Tonsil, Prostate	Cleared after tonsillectomy; Open Tb.		†	Scy.	
13	7	F	O.S.	Tuberculous iritis	28 days	6 mos.	0		Neg.	†	Tbc. hylus glands	None	Repeated A. C. hemorrhage	††	Stud.	0
14	38	M	O.D.	Iritis O. U.	21 days	Active	14 O. U.	6 wks.	Neg.	†	Prostate	?Gc., Hips, Spine	Response O. T. Rx; Chest, N & T Neg. Sinuses Neg. Sulfanilamide had no effect	†	Stud.	†
			O.S.	Iritis O. U.	56 days Recent Flare-up									†††	Neg.	0
15	29	M	O.D.	Iritis	21 days	6 wks	0		Neg.	†	Tbc.	None	Vitreous hemorrhage, 1936.	†††	Stel	
16	53	F	O.S.	Chronic iritis O. U.	8 years	Active	With exacerbations		Neg.	††	None	None		0	Neg.	0
17	38	F	O.S.	Chronic iridocyclitis O. U.	7 mos.	15 mos.	1	6 wks.	Neg.	† 1 Mg. Neg. .1 Mg.	None	None		†	Neg.	††
18	47	F	O.S.	Iridocyclitis, Sclerokeratitis O. U.	4 mos.	Active	With exacerbations		Neg.	†1 Mg. Neg. .1 Mg.	Teeth	None	Inj. O. T. gave swelling gland in neck	†	Dis. fil.	††
19	60	M	O.S.	Chronic iridocyclitis O. U.	8 years	Active	With exacerbations		Neg.	†1 Mg. Neg. .1 Mg.	None	None		0	Neg.	†
20	34	F	O.S.	Chronic iridocyclitis O. U.	7 mos.	Active	4	6 mos.	Neg.	Neg.	None	None	Tb. suspect; Rx. 1 yr.; Father Tb.	0	Neg.	†
21	36	M	O.S.	Iridocyclitis	2 yrs.	Active	Chronic with exacerbations		Neg.	†††	Gc.?Tb. Chest, Sinus	Knee	?Tb. chest and knee	†		††
22	71	F	O.D.	Operative uveitis; ? Sympathetic	33 days	Active	0		Neg.		None	None	Postoperative	††		†††
23	22	M	O.S.	Posterior uveitis; ? Cyclitis	1 year	Active	Chronic with exacerbations		Neg.	Neg.	None	None	Brother died rheumatic heart	0		†††

TABLE 4

GENERAL CLINICAL SUMMARY AND AQUEOUS FINDINGS

Appearance of Eye at Time of Aqueous Study										Aqueous							Remarks
											Smears						
Congestion	Cornea	K.P.	Cells	Flare	Synechiae	Lens	Iris	Vit. opac.	Nerve	Tension	Fluid c.c.	No. cells	Poly %	Lymph %	Other cells	Protein mg./100 c.c.	Clot	
††	Neg.	0	††††	††	††††		Vascular, succulent	0	Neg.	N	.2	†††	90	10			Slight fibrin	Anterior-segment involvement; aqueous gel later became uniform flare
††	Neg.	0	††††	††	†††		Vascular, succulent	0	Neg.	N	.2	†††	60	40		1616	gel	Stringy fibrin clot when water added to aqueous
†††	Neg.	0	††††	†††	†††		Muddy	††††	Cup	Hypo.	.2	†††	12	88			Fibrin in A.C.	Culture of aqueous negative
†††	Neg.	0	††††	††††	††	Clot over pupil		Not seen		N	.2	††	46	54	RBC	1224	gel	Fibrin clot after shaking fluid
†††	Neg.	0	Obscured by protein	††	†			0	Neg.	N	.2	†	0	100		300		
†††	Neg.	No slitlamp exam.		Large clot	†††		Muddy	Obscured		Hypo.	.15	†† RBC	30	70	RBC			
††	Neg.	0	†††† Suspended	†††	††††		Vascular	Obscured		Hypo.	.4	†††	62	38		1104	gel	Cells suspended in A. C.; Mucin neg.; Fibrin on adding water
††	Neg.	0	††	†††	††			0	Neg.	Hypo.	.31	†	20	80		800	Fibrin	See table 1
††	Sl. deg.	††	† Obscured by protein	††	††		Muddy; Two nodules	†	Neg.	N	.2	††††	Rare	99		1132	?	Onset during Rx with heavy metals; Cleared after arsphenamine
††	Neg.		††	†††	††		Vascular				.29	†††	45	55		480 (See table 1)		Onset during Rx with heavy metals; Cleared after arsphenamine
†††	Stip.		Obscured	Fibrin mass	††††		Meaty, nodular gumma	Obscured		††	.35	†††	85	15		1505	Fibrin	Mucin Neg.; Massive nodules pup. margin; Responded to arsphenamine
†††	Clear	0	††	††	††		Muddy	0	Neg.	N	.2	†	38	62		700 (See table 1)		Responded to extraction teeth; No anti-luetic Rx
†	Scar		No slitlamp exam.		††		Bound down			N	.2	††	50	50		559	Fibrin	Chest Neg. until Rx with O.T. for phylectenular conjunctivitis
††	Stip.	0	††††	††	††		Studded with white nod.	††	Neg.	†	.2	††††	?80	?20	RBC			Healed with O.T. Rx; Injected Aq. intracut. into † tuberculin reactor giving ? † tuberculin reaction
†	Stip.	†	††	††	†††	Post. cort. opac.		Obscured		N	.2	††	8	92		1535 (See table 1)	0	Yellow crystals as in case 40; Old chest foci; Brother died Tb.; Mucin Neg.
†††	Neg.	0	†††	†††	†††	Post. cort. opac.	Vascular	Obscured		N	.15	†††	55	45		1481	gel	Fibrin on adding water; tuberculin caused exacerbation
†††	Stip.	No exam.		Thick albumen ††††	No slitlamp exam.					N	.2	††	50	50		2500 after clot	Fibrin	Smear Neg. for Tb.; Eye cleared after aspiration (See table 1)
0	Neg.	0	†	††	††††		Sclerosed	0	Neg.	N Prev. Glauc.	.2	Rare	0	Rare				Injected intracut. into † tuberculin reactor. Gave no response
†	Neg.	††	†††	†	††		Koeppe nodule ††	†††	Neuritis ††	N	.3	†	0	100		50 (See table 1)	0	Inj. I.C. into † tuberculin reactor. Gave no response; Sl. eye reaction to 1 mg. O.T.; Responsded remarkably to O.T. Rx
†	Diffuse fil.	††	††	†	††		Vascular, sclerosed	††	Neg.	N	.3	Rare	0	Rare				Inj. I.C. into † tuberculin reactor. Gave no response; Herpes left side 6 mos. after onset
0	Neg.	†	†	††	†††		Atrophic, bound dn.	Not seen		N	.15	Rare	0	Rare		175		Has not responded to tuberculin
0	Neg.	†	†	0	†		Koeppe nodules †	†††	Neg.	N	.2	Rare	0	Rare				One previous attack assoc. with vit. hem.; Inj. into † tuberculin reactor. Gave no response
†	Iris	††	††	†††	†††		Atrophic bound dn.	Not seen		N	.15	††	15	85		1000 (See table 1)	Fibrin	
††	Iris	†††	††	†	††	Cat.	Atrophic, bound dn.	Not seen		††	.2	Rare	0	Rare clumps		160	0	
0	Iris	†††	††	0	0	Post. cort. opac.	Pup. active; edema sl.	†††	Neg.	N	.3	†	4	96		10 (See table 1)		Aqueous injected intracut. into † tuberculin reactor. Gave no response

TABLE 4—*Continued*

GENERAL CLINICAL SUMMARY AND AQUEOUS FINDINGS—*Continued*

No.	Age	Sex	Eye	Clinical Diagnosis	History				Probable Etiological Factors						Clinical Appearance	
					Present Illness		Previous Attacks	Average Duration	Wass.	Tuberculin	Foci	Arthritis	Miscellaneous	Congestion	Cornea	K. P.
					to Aqueous	to End										
24	59	M	O.D.	Iridocyclitis	1 year	Active	Chronic		Neg.	Neg.	None	Atrophic		0	Neg.	†††
25	63	M	O.S.	Glaucoma and iritis (lenticular)	8 days	1 wk.	0		Neg.	Neg.	None	None		†††	Steam	0
26	73	M	O.S.	Iritis; Acute lenticular glaucoma	2 days	3 days	0		Neg.	Neg.	None	None	Hypermature cat. Milky cortex	†††	Steam	0
27	77	F	O.D.	Lenticular glaucoma; ? Iritis	6 days	7 days	0		Neg.	Neg.	None	None	Immature swollen lens	††	Deep folds Steam	0
28	76	F	O.S.	Lenticular glaucoma; iridocyclitis	3 mos.	Enuc.	0		Neg.	Neg.	None	None	Cat. ext. O.D. 6 mos. before	††	Neg.	Lardaceous ††††
29	13	F	O.S.	Sclerokeratitis O. U.	1 mos.	6 mos.	1	4 mos.	Neg.	††	None	None	Juvenile Tb. Mother died Tb.	†	Steam	0
30	40	M	O.S.	Interstitial keratitis; Iridocyclitis O. U.	4 mos.	9 mos.	0		Pos.		None	None	Hg and Malaria previous to Aq.	†	Ground glass, no v	†††
31	34	F	O.D.	Interstitial keratitis	3 wks.	8 wks. Sl. Active	0		Pos.	Neg.	None	None	Deep striae of cornea	††	Round infiltrate	
32	8	M	O.D.	Sckerokeratitis O. U.	3 mos.	1 year	0		Neg.	††	None	None	At onset, No Tb. apparent	†	Nod. infiltrate	Ob
33	36	F	O.D.	Sckerokeratitis O. U.	2 mos.	Chronic	Exacerbations and remissions		Neg.	†††	None	None	Eye sensitive to tuberculin	†††	Marg infilt	0
34	31	F	O.S.	Sclerokeratitis O. U.	6 mos.	9 mos.	4	8 mos.	Neg.	†††	None	None	Eye sensitive to tuberculin	††	Early staphyloma	0
35	72	F	O.S.	Mild uveitis; Fuchs's corneal dystrophy	2 years	Active	Chronic		Neg.	Neg.	None	Slight	No free gastric HCl.	0	Bull kera	†
			O.S.	Mild uveitis; Fuchs's corneal dystrophy	2 yr., 8 mos.	Active	Chronic		Neg.	Neg.	None	Slight	No free gastric HCl.	0	Bull kera	†
36	59	F	O.S.	Acute glaucoma	2 mos.				Neg.	Neg.	None	None		††	Steam	0
37	65	M	O.S.	Acute congestive glaucoma	6 wks.				Neg.	Neg.	None	None		†††	Steam	Ob
			O.D.	Acute congestive glaucoma	7 wks.				Neg.	Neg.	None	None		†††	Steam	Ob
38	72	M	O.S.	Absolute glaucoma	2 yrs.	Recent Pain								††	Bull kera	Ob
39	69	F	O.D.	Hemorrhagic glaucoma	1 mo.				Neg.	Neg.	None	None	Diabetes	†††	Steam	0
40	60	M	O.D.	Spasmodic closure central ret. artery	5 hrs.									0	Neg.	0
41	50	F	O.D.	Absolute glaucoma	Pain 5 days								Old perf. inj. ? Sep. ret.	†††	Steam	0
42	65	M	O.D.	Glaucoma; Separated retina	Pain 1 mo.				Neg.				Detached retina 20 years	††	Steam	0
43	49	M	O.S.	Separated retina; uveitis	4 mos.								Old separated retina	Yellow sclera ††	Neg.	0

KEY TO ABBREVIATIONS:

Ppts. = Fine irregular precipitates on posterior surface of cornea; K. P. = Keratitic precipitates; Flare = Aqueous ray to slitlamp beam; P. I. = Present illness; Gc.

TABLE 4—*Continued*

GENERAL CLINICAL SUMMARY AND AQUEOUS FINDINGS—*Continued*

Appearance of Eye at Time of Aqueous Study										Aqueous							Remarks
											Smears				Protein mg./100 c.c.	Clot	
Congestion	Cornea	K. P.	Cells	Flare	Synechiae	Lens	Iris	Vit. opac.	Nerve	Tension	Fluid c.c.	No. cells	Poly %	Lymph %	Other Cells			
0	Neg.	†††	†††	†††	††††	Pup. membrane	Succulent, vascular	Not seen		Hypo.	.15		10	90		900		Drop of aqueous smeared on slide for cell study
†††	Steam	0	Large phous cles	amor- parti- †††	††	Hyper- mature	Atrophic, sclerosed	Obscured		†††	.32 Deep A.C.	††	9	91	Amor- phous debris	720 (See table 1)		Crusted cortex. Condition cleared 1 wk. after iridectomy and cat. extraction
†††	Steam	Obscured				Cat.		Obscured		†††	.2 Deep A.C.	Rare	0	Rare	Amor- phous debris	962		Condition cleared after iridectomy and cataract extraction
††	Deep fold Steam	Obscured			††††		Sclerosed, bound dn.	Obscured		††	.16 Shal- low A. C.	†	7	93		458	0	Mucin Neg.; Shallow A. C.; ? fibrin on lens; ? exfoliation of lens capsule
††	Neg.	Lardaceous ††††	††††	††††	††††	Hyper- mature	Vascular, bound dn.	Obscured		†††	.15	†††	16	84		3000 (See table 1)		Uveitis secondary to toxic lens material; Many eosinophiles in section
†	Scars	0	†	†	0			0	Neg.	N	.25	††	0	100		(See table 2)		Tuberculids of legs assoc. with eye; Simultaneous eruptions eye and leg
†	Groul glaus no v	†††	Obscured							N	.18	†††	25	75	Many clumps and epi- thelial cells	50 (See table 1)		No response to Hg or malaria; Immediate response to arsphenamine. Pigment granules seen on smear
††	Roun infil- trate		Obscured					Obscured		N	.15	†	0	100		Negli- gible (See table 2)	0	No vascularization of cornea; ? prenatal or acquired syphilis
†	Nod. infil- trate	Obscured					Obscured			N	.37	†††	20	80		25 (See table 1)		Active Tb. developed later
†††	Marg infilt	0	†	0	†		One Koeppe nodule	0	Neg.	N	.4	Rare	0	Rare		25 (See table 1)		Aq. inj. into † tuberculin reactor; ? positive; Better with O.T. Rx
††	Earl stapl loma	0	†	0	0			0	Neg.	†	.45	Rare	0	Rare		93		Aq. inj. into † tuberculin reactor, Neg. No response with O.T. Rx; Rapid response after hysterectomy for Ca. cervix
0	Bull kera	†	†	0	0	Imma- ture cat.	Atrophy, 1 Koeppe nodule	0	Neg.	N	.25	Rare	0	Rare		25 (See table 1)		Extreme flexibility of joints; Corneal tissue lacked turgidity; wrinkling when aqueous removed
0	Bull kera	†	0	0	0	Imma- ture cat.	Atrophy, 1 Koeppe nodule	0	Neg.	N	.25	†	2	98		25		
††	Steam	0	†	†	†††	Early cat.	Sclerosed	0	Cup	††††	.22	RBC	0	0	Rare RBC epi- thelial cells	(See table 2)		No retinal hemorrhage; Cleared after simple iridectomy
†††	Steam	Obscured			Oper- ative ††	Immat. cat.	Atrophic		Cup	††††	.25	RBC	0	0	Many RBC	(See table 2)		
†††	Steam	Obscured			††	Immat. cat.	Atrophic		Cup	††††	.30	RBC	0	0	Many RBC	(See table 2)		
††	Bull kera	Obscured				Ob- scured	Pupil ½ dil.	Obscured		††††	.2	†††	70	30		264	0	Recent deep central corneal infiltrate; ? cause of polys
†††	Steam	0	†	†	†	Immat. cat.	Fibrovas- cular membrane	Obscured		††††	.25	Rare	0	Rare	Clumps epithe- lial cells	190		See tables 1 and 2
0	Neg.	0	0	0	0	Normal	Normal	0	Pale	N	.25	Rare	0	Rare		76 (See table 3)	0	Transparent yellow needles; Aq. turbid in syringe. Vision recovered 20/30. Cells †† after aspiration. Mucin Neg.
†††	Steam	0	Obscured by protein			Cat.	Op. Colo- boma	Obscured		†††	.37	RBC †††	0	Few	RBC	552 (See table 2)	0	Question of separated retina
††	Steam	0	Obscured by protein		†††	Cat.	Fibrovas- cular membrane	Obscured		†††	.6	†	1	99	Many RBC	1) 1965 2) 2049	0 0	(1) 1st, and (2) last part of aqueous. Mucin Neg. in both parts of fluid. A.C. never flattened
ellow clera ††	N	0	Ob- scured by pro- tein	Sl. yellow †††	†††	Immat. cat.	Fibrovas- cular membrane	†††	Neg.	Hypo.	.25	Rare	Rare	Rare	Many RBC	1064	0	Mucin negative. A.C. never flattened after aspirating aqueous

illness; Gc. O. T.=Old tuberculin; A. C.=Anterior chamber; I. C.=Intracutaneous; Sl.=Slight; Nod.=Nodule; Neg.=Negative; N & T=Nose and throat; N=Normal; Pupil; †=Mild; ††=Moderate; †††=Marked; ††††=Severe.

on nonprotein nitrogen. It is insufficient to comment upon but gives some indication of being normal.

CELLS

Cell differentiation in each case is shown in table 4, and for the rabbits, in table 5. As would be expected, the ratio of polymorphonuclear cells to lymphocytes varies with the acuteness and intensity of the inflammation. This is further confirmed by the fact that eyes with a high percentage of polymorphonuclear cells had a high protein content and tendency toward clot formation, whereas others with equally high protein that did not clot had a low percentage of polymorphonuclear cells. Outstanding examples of the latter are seen in the cases of lenticular uveitis with glaucoma and separated retina (cases 25, 26, 27, 42, and 43). It was important to note if the ratio of polymorphonuclear cells to lymphocytes varied according to the etiology when the duration of the disease was about the same. This series shows no relationship of diagnostic significance, but it is too incomplete to exclude the possibility of the existence of some such relationship. This lack of dependency of cell type and etiology is exemplified in case 14, in which, at one stage of the disease, there was 8 percent of polymorphonuclear cells and later, after an acute flare-up of the same disease, 55 percent of polymorphonuclear cells. Another example is an instance of absolute glaucoma, case 38, associated with slight infiltration of the center of the cornea where there were many cells, 70 percent being polymorphonuclear cells, in contrast to other cases of glaucoma in which, even with high protein, there were relatively few cells in the aqueous. The percentage of polymorphonuclear cells then varies with the acuteness and intensity of inflammation regardless of its etiology. In chronic cases, likewise, the percentage of polymorphonuclear cells cannot be correlated with etiology. A high percentage of polymorphonuclear cells suggests an inflammatory condition usually associated with a high protein content and the presence of fibrinogen. Fluid with a low percentage of polymorphonuclear cells, even with a high protein content, is usually not associated with the presence of fibrinogen and suggests a noninflammatory process.

The normal aqueous is practically cell-free, containing only rare lymphocytes, as judged by our data on normal rabbits and in human aqueous with minimal number of cells.

PROTEIN

Consideration of the protein content of the aqueous proved to be the most interesting part of the study. The lowest protein in the group was 10 mg. total protein per 100 c.c. Our data suggest that, as in spinal fluid, any value up to 40 mg. per 100 c.c. should be considered normal.

A review of the records on the cases presented in table 4 and on the rabbits in table 5 shows that there are five distinct clinical groups relative to the protein content of the aqueous: (1) Eyes with acute anterior-segment uveitis, showing a high protein in a fluid in which a clot formed, including cases of acute tuberculous and syphilitic origin, and those attributable to a focus of infection. (2) Eyes with chronic iridocyclitis which were white and quiet but showed a high protein with less tendency to clot [cases 14 (first fluid), 19, and 24]. (3) Eyes with separated retina and lenticular uveitis with glaucoma with high protein and no tendency to clot. (4) Eyes with acute congestion from sclerokeratitis with low protein and no clot. (5) Eyes with primarily posterior-segment uveitis with low protein and no clot (cases 17, 20, 22, and 23).

Analysis of these groups shows that fluid samples with high protein content

and clot formation are characteristic of inflammations involving the anterior uveal tract. Fluids with high protein content and no clot formation are seen in conditions that may not be inflammatory and suggests a noninflammatory origin for the high protein. Acute sclerokeratitis does not involve the anterior uveal tract as much as has been heretofore suspected, the length of time it has been increased. With the possible exception of those minor adhesions attending localized iris infiltrates, as Koeppe nodules, synechiae are not seen unless the aqueous protein content has been increased.

Clinical implications

The results cited above are very much

TABLE 5

Aqueous studies on rabbits

No.	Date 1940	Appearance of Eye	Cells No.	Cells % Poly	Cells % Lymph	Protein Mg./100 c.c.	Clot
Rabbits Sensitized by Injecting Emulsion Tb. Bacilli in Groin 4/20/40							
1.	4/6	O.D. normal	Sheets epithelial cells				0
	5/24	O.D. injected Tb. bacilli into limbus					
	5/28	O.D. cong.*†: small corneal scleral nodule	†	63	37	154	†
	5/31	O.D. cong. ††: corneal scleral nodule larger	Few	(10 seen)	(5 seen)	68	0
	6/13	O.S. normal				45	0
2.	4/6	O.D. normal	Rare epithelial cell			26	0
	5/24	O.D. injected Tb. bacilli into anterior chamber					
	5/27	O.D. cong. ††††: cornea steamy	††††	55	45	4800	††
	5/31	O.D. cong. ††††: slight buphthalmus	†††	65	35	††††	
	6/7	O.D. cong. †††: cornea vascularized	†††	66	34	4173	††
	6/13	O.S. normal	Vitreous protein			80	
3.	4/6	O.D. normal	Few epithelial cells				0
	5/24	O.D. injected Tb. bacilli into limbus					
	5/27	O.D. cong. †: corneal scleral nodule	±	Rare	Rare	151	0
	6/13	O.S. normal				45	0
4.	5/24	O.D. injected Tb. bacilli into center cornea					
	5/28	O.D. cong. ††: central corneal abscess	††††	90	10	1500	††
	5/31	O.D. cong. †††: steamy cornea	†††	71	29		
	6/7	O.D. cong. †: cornea vascularized	Rare	Rare	Rare	165	0
5.		No injection into eye					
	5/31	O.D. normal	Vitreous protein 44; Mucin positive				
	6/13	O.S. normal	Aqueous mucin negative			53	
6.		No injection into eye					
	5/31	O.D. normal	Rare	0	Few		0
	6/13	O.S. normal	Vitreous protein 48; Mucin positive; Aqueous mucin negative				
Rabbits not sensitized							
10.	5/24	O.D. injected Tb. bacilli into limbus					
	5/28	O.D. cong. †: cornea-scleral nodule	Few	(18 seen)	(5 seen)	103	0
	5/31	O.D. cong. †: nodule same	Rare	(7 seen)	(3 seen)	69	0
11.	5/24	O.D. injected Tb. bacilli into limbus					
	5/28	O.D. cong. †: cornea-scleral nodule	Rare epithelial cell			76	0
12.	5/24	O.D. injected Tb. bacilli into center cornea					
	5/28	O.D. cong. ††: nodule center cornea	†††	76	24	1060	
	5/31	O.D. cong. ††: no change	††	72	28		†††
	6/7	O.D. cong. ††: cornea vascularized	Rare epithelial cell			675	†

*Cong.=Congestion.

judging by the low protein content of the aqueous. By the same criterion of low protein content of the aqueous, some cases of posterior-segment uveitis, even when there are many cells in the aqueous and many keratitic precipitates, may be unassociated with inflammation of the iris. Finally, it should be noted that synechiae vary with the extent of aqueous-protein increase, especially fibrinogen, and as would be predicted from a knowledge of the effects of inflammation on other body fluids, such as cerebrospinal fluid,[10] joint fluid,[11, 12] and so on. Information gained from the study of the aqueous is relatively not so enlightening as that gained from the study of cerebrospinal fluid, simply because fluid chambers of the eye can be examined by the microscope *in vivo* whereas those of the central nerv-

ous system cannot be so inspected. Nevertheless, this study of the aqueous has revealed some clinico-pathologic relationships not generally appreciated.

Cells. Study of the smears of the aqueous has shown that particulate matter resembling inflammatory cells by slitlamp examination in some cases is actually pigment, blood, or particles from the lens.

Dilating the pupil in elderly people occasionally releases a shower of pigment granules filling the aqueous. Rarely a "smoke-cloud" of pigment can be seen coming from a localized point under the iris. This phenomenon is frequently associated with exfoliation of the lens capsule.

The eye in case 3 (table 4) had an incredibly large fibrinous clot in the pupillary space. The aqueous smear showed principally red blood cells, partially explaining the origin of such a massive thick clot. In some instances blood in the vitreous, in conjunction with slight nuclear-lenticular sclerosis and seen through a small pupil obscuring the red reflex, may be diagnosed as simple cataract until the pupil is dilated and the slitlamp beam focussed on cells in the vitreous.

Case 25 (table 4) is an instance of acute glaucoma and hypermature lens, in which the aqueous was loaded with circulating amorphous particles. We at first interpreted these to be cells and treated the eye as manifesting secondary glaucoma. The condition became worse. On aspirating the aqueous, particles could be seen coming away from the old sclerosed lens, and the smear showed many amorphous particles and relatively few cells. In this case the protein content of the aqueous was high. The question arises then whether the high protein might also have been derived from the lens, since its origin was not on the basis of uveitis, judging from the presence of so few cells. Subsequently iridectomy and cataract extraction resulted in a useful eye.

In addition to the misinterpretation of particulate matter for cells by slitlamp examination, the presence of inflammatory cells may be obscured by a dense protein flare. We have often seen cases of uveitis in which, at an early stage, there were many cells. Later these were masked by the aqueous flare, and made their appearance again as the protein decreased at a later stage in the disease. Smear examination or even examination with highest magnification of the corneal microscope proved that the cells were greatest in number when the protein was so much increased as to obscure them. This does not mean that a high protein content is always associated with the presence of many cells. We have seen cases of high aqueous protein in which there were only rare cells (cases 25, 26, 27, 42, and 43). These were in patients with glaucoma secondary to hypermature cataract and with old detached retinae.

An important possibility from study of aqueous smears concerns the diagnosis of tumors, similar to the identification of tumor cells in serous effusions[13] and in thoracic and abdominal fluids.[14] We have seen three cases of retinoblastoma that showed what appeared to be keratitic precipitates on the posterior surface of the cornea, and the condition had been diagnosed as an inflammatory one. These keratitic precipitates proved to be collections of tumor cells. It would seem that the diagnosis in such cases might better be confirmed by aqueous studies.

Protein. With a little practice one can judge the protein content of the aqueous roughly by the aqueous flare. Some cases, however, are confusing. In extremely acute processes the aqueous seems to be a gel and the cells can be seen suspended motionless in this transparent gel. Later

a semitransparent clot may precipitate out, allowing some circulation of cells to occur. Later still the clot loses its transparency and appears more as fibrin. At times, in more chronic cases, thin strands of fibrin can be seen stretching across the anterior chamber. Subsequently the clot undergoes complete dissolution so that the aqueous presents a uniform dense flare to the slit-lamp beam. During all these stages the actual total protein content of the aqueous may change insignificantly. It is the state of the protein that changes. This series shows a number of cases in which the fluid did not clot in spite of a total-protein level far above that found in other cases in which clot formation occurred.

Protein and synechiae. Examination of table 4 shows a close correlation between the extent of synechiae and the increase in aqueous protein, or, even more significant, the absence of synechiae in posterior uveitis when the aqueous total protein is low. This observation has a very practical application in posterior-segment uveitis and sclerokeratitis in which the aqueous protein is often normal or but slightly elevated. In such cases there need be little fear of synechia formation; consequently, if glaucoma complicates these cases with low protein, miotics can be used safely during the acute stage. We[1] have reported two cases of rather acute glaucoma showing keratitic precipitates and cells. Mydriatics, including the adrenalin derivatives, made the eyes worse. Ordinarily tension in such eyes would be controlled by Reese incision or repeated paracenteses. However, in the presence of low aqueous protein, as judged by absence of flare, miotics were used very effectively. Subsequently the uveitis subsided, tension became normal, and no synechiae had formed. The eye in case 34 showed beginning staphylomatous change of the cornea subsequent to slightly increased tension associated with sclerokeratitis. This tension was controlled satisfactorily by use of miotics, and no synechiae developed.

In such conditions as separated retina, retinal hemorrhage, intraocular tumor, and possibly hypermature cataract, synechiae also accompany a high aqueous protein, but to a less degree than in iritis. Nevertheless, the protein is sufficient to stimulate fibrovascular formation on the iris and in the angle, affording a pathogenic explanation of the hemorrhagic glaucoma that occurs as an end result in these conditions. This pathogenesis offers a possible explanation of why this type of glaucoma is often made less irritable by the use of mydriatics in contrast to miotics, since it is known that mydriatics decrease the aqueous protein.

In so-called chronic "quiet" iritis, in which the eye shows no redness and is not painful, the slitlamp shows an increase in aqueous protein and many synechiae associated with relatively few cells (as in case 24), suggesting that the increased capillary permeability producing this increase in protein is not the result of infectious nor traumatic inflammation. This type of aqueous with high protein is seen accompanying the iritis of some arthritic patients and occasionally in eyes following trephining operation when the tension remains unusually low. The obvious treatment indicated is to raise the tension by the use of mydriatics, the treatment which is usually prescribed. The tension could be further increased in the instances of quiet iritis following trephining by reducing the filtration bleb with the application of mild caustics, such as trichloracetic acid, to the edge of the filtration area. Recently we have seen two cases of quiet iritis following trephining which showed extremely low intraocular tension that subsequently increased to normal, after which the iritis cleared spontaneously. There was no evidence of cyclitis in these cases to explain the low

tension, as there were no keratitic precipitates, and the gonioscope revealed the corneoscleral angle to be free of any iris or ciliary-process adhesions.

Aqueous protein in relation to uveitis and glaucoma caused by toxic lens material. The eyes in two cases (25 and 26 in this series) had acute congestive glaucoma secondary to hypermature cataract, as judged by the immediate response to cataract extraction resulting in normal eyes. During the acute stage the aqueous of these eyes showed a high total-protein content and relatively few inflammatory cells. The possibility that some of the protein came from the lens is suggested by the observation in case 25 of amorphous material coming away from the lens during the aspiration of aqueous and by a third case (case 28). Here a hypermature cataract resulted in a uveitis and secondary glaucoma, necessitating removal of the eye. Pathologic examination by Dr. Frederick H. Verhoeff showed a posterior capsule undergoing dissolution and vitreous containing broken-down lens material. Dr. Verhoeff (personal communication) interpreted the uveitis as secondary to toxic lens material and felt that the eye could have been saved had the lens been removed. This type of case challenges our diagnostic ability, and it is hoped that further aqueous studies, especially in regard to the total protein of the aqueous in various types of glaucoma and hypermature cataract, may help in determining uveitis and glaucoma of this origin.

Quantity of aqueous. Finally, quite by accident, our studies have led to interesting clinical observations relative to the amount of fluid obtainable.

(1) From eyes with sclerokeratitis considerably more than the average amount of fluid was obtained readily, suggesting that the inflammation involves the iridocorneal angle, interfering with elimination of aqueous in this region. As already mentioned, miotics can be safely used in these cases if tension becomes elevated.

(2) While aspirating the aqueous from an eye with absolute glaucoma, we noticed that we had withdrawn 0.4 c.c. of fluid without flattening the chamber, although the eye was soft. Assuming that the anterior chamber contained vitreous, we continued to withdraw another 0.6 c.c. of fluid to compare protein content in the first and last fluid withdrawn. Subsequently we learned from the history that a separated retina had been present in this eye for 20 years. Analysis of the aqueous showed low cells and high protein, and no difference in protein of the first and last portions of the fluid. Also, the protein was higher than that for normal vitreous and the test for mucin was negative. The test for mucin was positive in rabbits' vitreous in the presence of a normal protein. The fact that the reaction was negative in the fluids from the eye in this case of separated retina and from that in the following separated-retina case would indicate that we had no vitreous in the samples or that mucin in the vitreous of these eyes had been depolymerized and so was not precipitated with acetic acid. Pathologic examination of the eye showed a typical picture of old separated retina with vitreous drawn up behind the lens, and dense subretinal coagulum. Undoubtedly, then, the fluid drawn into the anterior chamber was not vitreous but the transudate composing the subretinal and preretinal fluid. The eye in case 43 presented an old separated retina and secondary iritis. The patient had faint light projection in spite of the old detachment. He refused operation for the detachment but consented to aspiration of aqueous. The same phenomena occurred of failure of the anterior chamber to flatten, even after large amounts

of fluid had been withdrawn. Also, the aqueous was high in protein and low in cells. This observation suggests a possible means of diagnosis of old separated retina in cases in which the posterior segment is obscured from view, as by cataract or hemorrhage.

General Summary and Conclusions

Aqueous was aspirated and various chemical determinations made in 44 cases of intraocular disease, including uveitis, glaucoma, and separated retina, and from the eyes of 12 rabbits with experimentally induced sclerokeratitis. The methods used for obtaining and analyzing the aqueous are included. The data are too limited to draw final conclusions, but the following relationships are indicated:

1. The sugar content of the aqueous varied primarily with the blood-sugar level. It could not be correlated with the etiology of the pathologic process, but tended to be lower in cases of acute inflammation, perhaps because of glycolytic ferments entering the aqueous in these cases.

2. The ratio of aqueous to serum chloride averaged 1.21, approximating that for cerebrospinal fluid to serum chloride, and was not altered in glaucoma.

3. The cell response was affected primarily by the acuteness and intensity of the inflammation and not by the etiology.

4. A high percentage of polymorphonuclear cells was usually associated with high protein content of the aqueous, which had a tendency to clot. This type of aqueous was characteristic of inflammation of the anterior uveal tract.

5. The eyes in certain cases in this series showed a high aqueous protein associated with relatively few cells and no clot formation, findings suggesting a noninflammatory basis for the increased protein. These included cases of separated retina, "quiet" iritis, and uveitis with glaucoma secondary to hypermature cataract.

6. Increase in protein content of the aqueous was associated with synechiae varying with the length of time the protein had been increased and probably with the percentage of fibrinogen. Certain conditions, such as posterior-segment uveitis and sclerokeratitis, may be unassociated with increase in aqueous protein, and in such cases synechiae do not form. Glaucoma complicating these conditions during the acute stage can be treated with miotics without fear of synechia formation.

7. In cases of old separated retina, aspiration of the aqueous draws preretinal and subretinal fluid into the anterior chamber, preventing its collapse, a finding which may be of diagnostic importance in determining the existence of an old detachment in the presence of an obscured posterior segment.

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DISABILITY LAWSUIT FOLLOWING SUCCESSFUL BILATERAL CATARACT EXTRACTION*

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Recently we were employed in a disability suit to prepare an ophthalmologic vocabulary and series of ocular facts apropos to the case. This lawsuit is known under the title Claude D. Stewart vs. Home Life Insurance Company of New York [reported in 29 F. Supp. 834, and 114F. (2d) 516]. It seemed to us that the legal arguments, reasoning, and conclusions involved would be of interest to us, not only as ophthalmologists, but also as insurance policyholders.

A policy of disability insurance of considerable magnitude contained the following significant clause (note the wording): *"The irrecoverable loss of sight in both eyes,* or the total and permanent loss by accident or disease of the use of both hands, or both feet, or of one hand or one foot, shall constitute total and permanent disability. . . ." Many years after the issuance of the policy, the holder developed cataracts which were successfully removed and he returned to his work as a real-estate agent. In cogitating about his situation, the claimant apparently noted that the policy said "loss of sight *in* the eye" and, realizing that no lens could be put back in the eye, he made application to the company for total disability benefits. The insurer refused the request and the policyholder brought suit to force collection. The case was tried in the Federal District Court at Denver.

To conserve time and avoid unnecessary argument, the attorneys for the claimant and the insurance company agreed on the following (and many other) statements as admitted facts, and the case was submitted to the Court on such stipulated facts.

(1) "After the issuance of the policy, the plaintiff had developed cataracts which had been successfully removed.

(2) "The lens, which has now been removed from each of the plaintiff's eyes, cannot be replaced by another natural lens, under any practice or technique known to present medical science.

(3) "By reason of plaintiff's inability properly to get an exact focus on the retina of the eye as a result of the removal of the natural lens, vision with respect to each of plaintiff's eyes is now less than 20/400 without the use of an artificial lens.

(4) "By means of an artificial lens used externally in the same manner that any spectacle lens is used, plaintiff can and does focus rays of light on the retina of the eye with practically the same effect and results as through the medium of a normal, natural lens.

(5) "Without the use of artificial lenses, the plaintiff has no useful sight in an economic or industrial sense. With the use of artificial lenses, he has (for the purposes of this case) normal vision. The word, sight, as used in the policy, means (for the purposes of this case) useful sight in an economic or industrial sense.

(6) "Insofar as material to this case, there is no pathological degeneration or impairment in the plaintiff's visual apparatus except the aforesaid loss through operative means of the natural lens of each eye.

(7) "The plaintiff has been able to engage in, and now is engaging in, an occupation for compensation or profit."

* Read before the November, 1940, meeting of the Colorado Ophthalmological Society in Denver.

(8) Vision is not located in the eye alone, but consists of four phases, the optic, the retinal or receptive, the conductive, and the perceptive.

(9) Vision may be lost by involvement of any one or more of these phases.

(10) The various means by which vision may be recovered are by natural healing or through surgery, medication, glasses, or physical therapy.

The case was tried before a judge (without a jury) and he ruled in favor of the policyholder, basing his opinion on the following arguments, referring frequently to decisions in previous lawsuits:

(1) "It is a cardinal principle of insurance law that a policy or contract of insurance is to be construed liberally in favor of the insured and strictly as against the company.

(2) "Surgery is not an exact science, and it would be a harsh rule that required an insured to undergo the risks of a major, delicate operation, especially on the eye, as a condition precedent to fixing liability on the insurer."

(3) It has been held in suits that loss of both legs constitutes total disability even though the claimant can walk with artificial limbs. "The plaintiff's eyes do not now function as nature intended, nor can it be said the use of glasses restores vision any more than an artificial leg replaces an amputated leg."

(4) If a man loses a major part of a hand, he is given compensation for the "total loss of the use of a hand because the normal use has been taken entirely away."

(5) In some cases arising under Workmen's Compensation Acts it has been decided (the Industrial Commission in this state has so ruled as to cataracts, for example) that disability should be determined on uncorrected vision and "that compensation so fixed and determined will not be diminished by reason of the fact that the disability may in a measure be overcome by artificial means." And further, "devices such as glasses, artificial limbs, and so on, are at the best a poor substitute, and uncertain and variable as to time and degree of effectiveness."

(6) "The defendant was the draftsman of the policy and in the absence of more explicit language we are not persuaded the insured would have taken the policy with notice of the construction the insurer now seeks to have placed upon this clause [Woolworth Co. v. Petersen, 78 Fed. (2d) 47], which is, in effect, that a disabled insured must, as a condition precedent to recovery, turn himself over to the insurer's doctors for medical experimentation with no guarantee of results or provision for expenses or loss of time.

(7) "It must also be borne in mind that glasses afforded no relief from the blindness caused by the cataracts until after plaintiff of his own volition and at his own expense underwent the operation."

The insurance company then appealed the case to the Circuit Court of Appeals, Tenth Circuit, who, in reversing the decision of the lower court, used the following reasoning:

(1) "It is well settled in Colorado that in case of doubt or ambiguity a contract of insurance is to be construed in favor of the insured and against the insurer, . . . but that rule does not go to the extent of making a plain contract doubtful or ambiguous and then interpreting it in favor of the insured. Too, the natural and obvious meaning of the provisions in a contract are to be adopted in preference to a fanciful, curious, or hidden meaning.

(2) "The provision of the policy in question does not insure against the loss of the lens or any other physical part of

the eye. It insured against the loss of sight. The coverage is limited by the plain language of the contract to the loss of function, and does not embrace the loss of any part of the physical eye.

(3) "And the loss must be irrecoverable. Through a cataractous condition the insured lost substantially all of the sight in both eyes. And it may be that under the law of Colorado he (the plaintiff) was not obligated to submit to surgery as a prerequisite to recovery upon the policy . . . but we do not explore that question because with commendable courage he voluntarily underwent two operations for the removal of the lenses. He wears glasses, and it is stipulated that with their use he has normal vision."

(4) The higher court cited a case where "recovery was sought on a disability policy which provided that the entire and irrecoverable loss of sight in both eyes would be considered as permanent and total disability. Due to a cataractous condition, Plaintiff had suffered such impairment of sight in both eyes as to prevent him from performing the substantial duties of any occupation or labor, and his condition was permanent. But the undisputed evidence was that through removal of the cataracts by surgery, and the use of glasses, the restoration of normal or substantially normal vision could reasonably be expected. The court held that the loss of sight was not irrecoverable within the meaning of the policy, that instead it was wholly or partially recoverable, and that in either event recovery could not be had. The case seems to bear analogous application."

(5) As regards the lower court's analogy of the loss of legs as constituting total disability, the higher court said "The loss of both feet or both legs and the use of cork or wooden substitutes on one hand, and the loss of sight in both eyes resulting from a cataractous condition and its restoration through surgery and the use of glasses on the other, cannot be regarded as closely akin in respect to disability. In general concept they are so widely apart that they do not bear any reasonable analogy. The difference is too plain to call for elaboration."

(6) "Glasses are worn by a substantial proportion of people of all ages. Many of them have very little vision in the natural eye, but with the use of glasses their vision is substantially normal for all practical purposes. They pursue their business and professions with success. They meet in competition those with normal vision in the natural eye, and they are not seriously handicapped. It cannot be said that they have suffered the irrecoverable loss of sight. Here, it is stipulated that for the purpose of this case, the insured has normal vision when he wears glasses. A court cannot say in a single judicial breath that he has suffered irrecoverable loss of his sight within the meaning of the policy and at the same time that he has normal vision. The two are so diametrically in conflict that they cannot be brought into parallelism. The provision in the contract embraces the loss of sight by atrophy of the optic nerve or in some other manner which is irrecoverable, but it cannot be reasonably construed to cover a case where sight was lost, but, resulting from surgery and the use of glasses normal vision is again enjoyed."

One can see that, if the judgment of the lower court had not thus been reversed, the ruling might have been extended by being construed to apply to errors of refraction and even to simple presbyopia. Such a liberality in the interpretation of this clause could, of course, ruin any insurance company doing this type of business.

However, if the policy were to be construed in the claimant's original limited contention of *in* the eye, then such blindness due to conditions as brain lesions, optic atrophy, a severence of optic nerves by gunshot, or skull fracture would not be covered—an obviously unfair interpretation.

Metropolitan Building.

INTRAEPITHELIAL EPITHELIOMA OF THE CORNEA AND CONJUNCTIVA (BOWEN'S DISEASE)*

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In 1912 Bowen,[1] an American dermatologist, published an account of two patients with peculiar, extremely chronic lesions of the skin which he regarded as belonging to an ill-defined group of precancerous dermatoses. He carefully described the clinical and microscopic characteristics of the lesions, which he called precancerous dyskeratosis, and prophesied that they would undergo malignant change if not completely destroyed. This prophecy later proved to be correct.

In 1921 Jessner[2] reported for the first time the occurrence of a similar process on a mucous membrane. Since then many cases of both skin and mucous-membrane lesions have been recorded.

A careful search of the literature, both general and ophthalmic, reveals no report of a case of Bowen's disease involving the eye or its adnexa.

In 1932 Weyman[3] published a paper on diffuse papillomatosis of the limbus, in which E. M. Butt made the pathologic report. The latter stated that the epithelial change was qualitatively similar to that seen in Bowen's disease of the skin, but he felt that the diagnosis of that case was papilloma.

Dr. Butt has kindly permitted me to study the sections in this case. The tumor is partially intraepithelial, but shows some evidence of local invasion. The appearance of the cells and their arrangement are not quite characteristic of Bowen's disease, but more like an atypical squamous-cell epithelioma *in situ* or Bowenoid epithelioma. Dr. A. P. Stout has studied these sections and agrees that the lesion is a Bowenoid squamous-cell epithelioma which shows local invasion.

The literature has been fully reviewed recently by Stout,[4] who discussed the malignant manifestations of Bowen's disease, and by Cipollaro and Foster,[5] who reviewed all reports of mucous-membrane lesions and reported the first instance of involvement of the tongue. None of these writers had encountered cases or reports of Bowen's disease involving the eye.

At the Eye Institute we have seen five specimens which we believe show the histopathologic changes of Bowen's disease occurring in the cornea and conjunctiva. Two of the patients were seen clinically and all five lesions have been studied microscopically.

There are many reports of epithelial tumors of the cornea and conjunctiva under the names of basal or squamous-

* From the Institute of Ophthalmology, Presbyterian Hospital, and the Department of Ophthalmology, College of Physicians and Surgeons, Columbia University. Cases presented before the Eye Section of the New York Academy of Medicine, December 16, 1940. Received for publication July 5, 1941.

cell carcinoma, nevo-carcinoma, papilloma or papillomatosis, epithelial plaque, simple epithelial hyperplasia, and xeroderma pigmentosum. Some of these would probably prove to be Bowen epitheliomas if reviewed with this possibility in mind.

The clinical course of these lesions is so unusual, the microscopic picture so characteristic, and the problem of therapy so challenging that a discussion of the subject is in order.

Clinical appearance

The lesions which we call Bowen's disease appear on the cornea and conjunctiva as slightly elevated, diffuse, sometimes multiple, highly vascularized patches of reddish-gray, gelatinous tissue. In one patient whose bulbar and palpebral conjunctivas were extensively involved, the new growth had a yellowish-gray membranous appearance. These tumors arise from epithelium and may remain entirely within the epithelium for years without breaking through the basement membrane to show the usual tendency of epitheliomas to invade or metastasize. By analogy with skin and mucosal Bowen epitheliomas, they may be expected to invade and metastasize if given sufficient time. Bowen epitheliomas are said to be capable of metastasis without invasion of the basement membrane, as is the case with melanomas, extramammary Paget's disease, and erythroplasia of Queyrat. Bowman's membrane offers a barrier to invasion by all corneal tumors.

There is always considerable inflammatory reaction beneath the new growth, sometimes enough to mask the tumor entirely. In one of the cases to be reported, the new growth started in a pannus crassus of trachoma. In a second case the lesion occurred in an eye injured 14 years previously. In a third case the cornea had been burned 13 years previously and had become ulcerated three years after that. However, in the other two cases there was no history of antecedent injury, inflammation, irradiation, or exposure. In none of the cases was there evidence of invasion or metastasis (fig. 1).

The clinical appearance of the lesion necessitates differential diagnosis between (1) pannus from any cause, (2) filtering cicatrix of the cornea, (3) Mooren's ulcer, (4) epithelial proliferation following radiation, (5) xeroderma pigmentosum, (6) fatty degeneration of the cornea, and (7) epithelial dystrophy of the cornea. The diagnosis can be only suspected clinically; the established diagnosis depends upon microscopic examination of excised tissue. Epithelioma was suspected in three of the cases reported, Bowen's disease was suspected in one, and the possibility of a new growth was unsuspected in one.

Typical pannus is readily recognized. If it is unusually thick or more extensive than that expected by the severity of the disease producing it, the possibility of a new growth should be considered (case 1).

Filtering cicatrix of the cornea appears as a bluish-white, irregularly ectatic scar which extends through the full thickness of the cornea in an eye with normal or slightly subnormal tension. It almost always follows injury or operation.

The course of Mooren's ulcer and the loss of substance rather than an increase in tissue facilitate differentiation of this condition from Bowen's disease.

Proliferation of corneal epithelium following radiation may simulate an intraepithelial epithelioma. The history and the usual tell-tale evidence of skin and conjunctival damage by radiation are sufficient for diagnosis.

Xeroderma pigmentosum is easily diagnosed by the lesions of the skin which antedate ocular involvement, usually by some years.

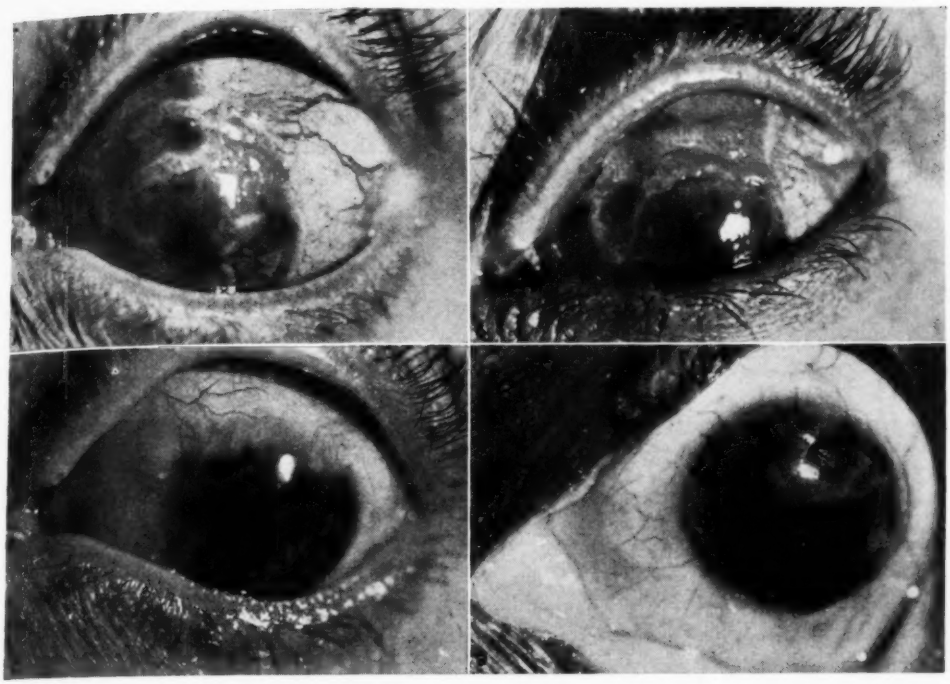

Fig. 1 (McGavic). A, Case 1: Clinical appearance of pannus with intraepithelial epithelioma covering the upper one-half of the cornea; B, same as figure 1 with the patient looking down; C, Case 1: Appearance of the cornea after removal of the pannus and epithelial tumor. Bowman's membrane was not injured; D, Case 2: Clinical appearance of intraepithelial tumor of the cornea. Note the vascularity of the lesion.

In fatty degeneration a yellowish-gray discoloration is seen beneath the epithelium, always bilaterally.

Epithelial dystrophy presents sufficiently characteristic slitlamp findings for definite diagnosis.

Microscopic appearance

The histopathologic appearance of Bowen's disease of the skin will be given here, and the description of the findings in each reported case of corneal involvement will be given with the case report.

The epithelium is thickened, and in the skin there are hyperplastic deranged pegs formed by the rete cells, giving a papillary appearance. Many of the epithelial cells show great variation in size, shape, and staining characteristics. Mitotic figures are of bizarre configuration with disordered polarity and may be more numerous than in cases of straight-forward basal or squamous-cell epithelioma. Single nuclei may reach a tremendous size, and are called "monster" cells. These may have single large nuclei or may be multinucleated with the nuclei clumped together (clumping cells of Bowen). Division by amitosis may be demonstrable. The cytoplasm of the cells is often vacuolated. When extreme vacuolization occurs, the nucleus is completely surrounded, the two membranes giving a double-ringed appearance to the cell. These are the "corps rond" of Darier. Intercellular bridges may be shown, but intercellular fibrils are often not demonstrable. Surface cornification and parakeratosis with granule formation may be present. The basal cells may proliferate

and lose their neat palisade arrangement, but there is no rupture of the basement membrane in this process. Infiltration by lymphocytes, plasma cells, and histiocytes is present beneath the epithelium as a rule. This, together with the increased vascularity, gives the lesion the false appearance of an inflammatory process. The cellular variation and unrest peculiar to Bowen's disease have been called "poikilokarynosis" by Darier;[6] these features are necessary for the diagnosis of Bowen's disease (figs. 2, 3).

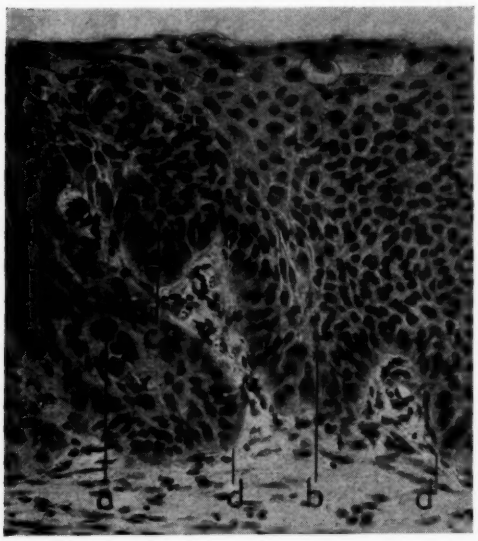

Fig. 2 (McGavic). Case 3: Photomicrograph showing proliferated rete pegs a, b, and c, without violation of the basement membrane, d. Note the marked variation in cells and evidence of cellular unrest (poikilokarynosis).

In the cornea the new growth may follow the limbus or may occur at multiple sites. The change from normal epithelium to the new growth is abrupt. Between the tumor and the uninvolved Bowman's membrane, the inflammatory reaction and new blood-vessel formation can be seen.

There has been no little controversy about the classification of Bowen's disease. Some pathologists refuse to recognize it as an entity distinct from basal or squamous-cell carcinomas *in situ*. They feel that the microscopic evidence is insufficient to necessitate separate classification. Some dermatologists and pathologists regard the lesion as a precancerous dermatosis, and look forward to possible malignant change as in precancerous melanosis, Paget's disease, xeroderma pigmentosum, and erythroplasia of Queyrat. Others feel that the lesion is a car-

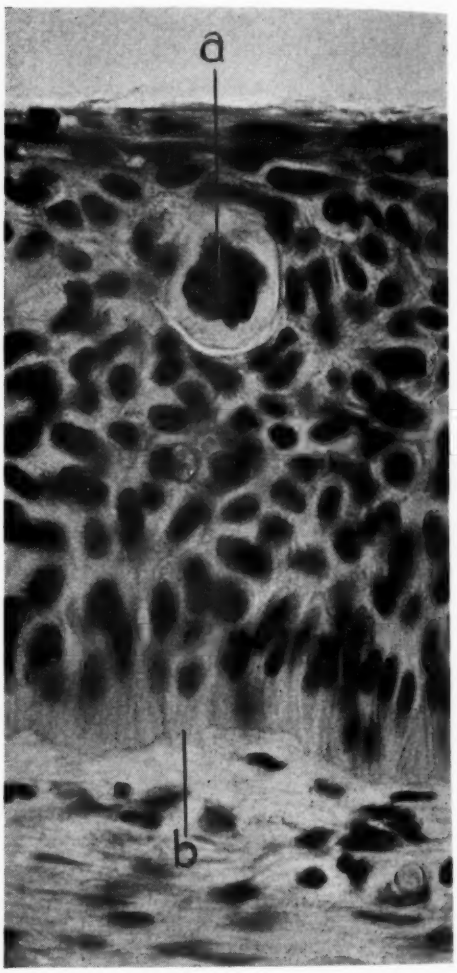

Fig. 3 (McGavic). Case 5: Photomicrograph (high power) showing a monster cell, a, with clumped nuclei in its center (clumping cell of Bowen). The marked variation in the proliferating cells is well demonstrated. Unviolated basement membrane, b.

cinoma from its onset and should therefore not be classified as precancerous.[7] Certainly it is true that although the new growth remains localized without even microscopic evidence of invasion or clinical evidence of metastasis for as long as 30 years, there are reports of malignant change in 40 percent of the mucous-membrane lesions and 3 percent of the skin lesions.[4]

It seems advisable to call this lesion a Bowen epithelioma to denote that the tumor not only is intraepithelial, but that it also shows the cellular changes regarded as necessary for the differentiation from ordinary epithelioma *in situ* or Bowenoid epitheliomas.

Cancerous change of a Bowen lesion is always slow and may be manifest clinically in two ways. In one group an atypical squamous-cell epithelioma may arise from a portion of a Bowen lesion and from an ulcerating or fungating tumor mass (case 4). These lesions may then be locally infiltrative, but do not metastasize.

In the second group metastasis may occur without clinical evidence of local invasion. In several such cases there has been microscopic evidence of slight invasion that could not be detected on clinical examination. This is one of the peculiarities of Bowen's disease. In this second group there are the cellular changes called poikilokarynosis without the features of epidermoid carcinoma in either the primary or the metastatic tumor.

Civatte[8] has stated that in his experience clinical evidence of cancer has not developed except in cases of trauma by incomplete local destruction.

Other lesions histologically similar are: 1. Ordinary basal and squamous-cell carcinomas, especially when seen early or when the biopsy specimen does not show invasion of the basement membrane. Epitheliomas *in situ* may lack cellular changes necessary for a diagnosis of Bowen epithelioma. 2. Xeroderma pigmentosum. 3. Arsenical keratosis (arsenic is said to play a role in the pathogenesis of some cases of Bowen's disease[1,6,7,9,10] (see case 1). 4. Precancerous melanosis[11] and diffuse malignant melanoma of the conjunctiva and skin. 5. Intraepidermal melanoma.[12] 6. Senile keratosis. 7. Radiation dermatitis and carcinoma. 8. Leucoplakia. 9. Cancer in workers with paraffin, and so forth. 10. So-called epithelial plaque or congenital benign epithelioma of the limbus.[13]

Case reports

Case 1. A. A., a white female, aged 46 years, was first seen in the Vanderbilt Clinic in March, 1937, with a history of having had trachoma for many years. Vision was R.E. 20/100, and L.E. 20/40. A diagnosis of trachoma grade III was made. There was a pannus crassus covering the upper one third of the cornea of the right eye. Treatment given was local applications of silver nitrate and copper sulfate.

The patient was lost to the Clinic from July, 1938, to April, 1939. Reëxamination revealed still active trachoma, grade III, with a heavy, fleshy pannus over the upper third of the cornea of the right eye. The patient was admitted to the Eye Institute and given sulfanilamide orally for three weeks. At the end of this time, the trachomatous process appeared to be inactive, but the fleshy pannus appeared more striking than before because the rest of the eyeball was then almost free from the congestion previously noted around the pannus. The pannus covered the upper half of the pupillary area.

A tentative diagnosis of epithelioma was made by Drs. John H. Dunnington and Phillips Thygeson. The patient was admitted to the hospital for surgical removal of the pannus with suspected tumor. Removal of this tissue was very easy as it was stripped away from the cornea, leaving Bowman's membrane intact. Healing was uneventful with the cornea clear at the site of the pannus. An extensive grayish-yellow membranous thickening of the bulbar and upper palpebral conjunctiva was seen, and a clinical diagnosis of tumor extension was made, but this area was not excised.

The excised tissue was sectioned and found to be an epithelioma confined to the epithelium and not invading the underlying pad of vascularized connective tissue which separated the tumor from Bowman's membrane. The sections were also studied by Dr. A. P. Stout, who made

a diagnosis of Bowen's disease and pointed out the differentiation from ordinary epithelioma *in situ*. The following report is by Dr. Stout: "The conjunctival epithelium was thickened throughout the entire specimen except at one margin, where the thickening ended abruptly as it joined a tiny fragment of normal mucosa. The thickening was due to a proliferation of

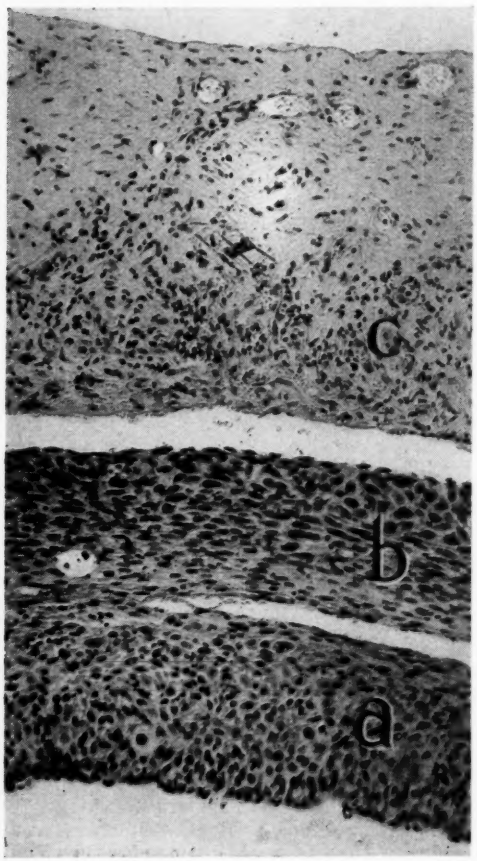

Fig. 4 (McGavic). Case 1: Biopsy specimen from corneal tumor. The proliferated epithelium, a, and b, has been folded upon itself before sectioning. Beneath the epithelium is the pad of vascularized connective tissue, c, originally a pannus of trachoma.

epithelial cells which were no longer arranged in layers but in a disorderly fashion. The cells were hyperchromatic, varied in relative size, showed mitoses on an average of one to every high-power field, and bizarre giant cells with either clumped nuclei (Bowen cells) or a single giant nucleus. There was no hyperkeratinization. These evidences of cellular unrest are characterized by the term poikilokarynosis. There was no violation of the basement membrane. In the submucosa was a marked inflammatory reaction. This is a characteristic case of Bowen's disease, occurring in the conjunctiva" (fig. 4).

The submucosa was actually a pad of vascularized connective tissue which was surrounded by a thin but definite capsule. This tissue apparently represented the original pannus of trachoma lying between Bowman's membrane and the epithelium which had undergone the atypical epithelial proliferation.

Because of the diffuse extent of the lesion over the bulbar and upper palpebral conjunctiva, surgical excision of the entire lesion was not considered feasible. Border-ray therapy was advised and given by Dr. R. L. Pfeiffer. A total of 800 r units was delivered, the portals being directed at two areas above the cornea to either side of the midline. Technical difficulties prevented treating the entire extent of the conjunctival tumor. Border rays were used because it was felt that there was less chance of producing a radiation cataract than by the use of X ray or radium. In theory, border rays seemed to offer sufficiently penetrating effect to destroy so superficial a tumor.

In July, 1940, corrected vision in this eye was 20/30. There was no evidence of recurrence on the cornea. The conjunctival portion of the tumor seemed to have been destroyed after the reaction to the border-ray treatments had subsided.

In April, 1941, the upper bulbar conjunctiva near the inner canthus was thickened, partially filling the upper fornix. There was no fungating tumor growth, but the upper lid appeared to be partially fixed when palpated. No regional lymph-node involvement could be found. A specimen for biopsy was taken from this area. The epithelium showed the cellular characteristics of the original tumor. The cells appeared to have received a sublethal dose of radiation and it was felt that furthor growth of the tumor *in situ* could take place. Further observation will be necessary to determine this. A second suspicious area was noted just above the limbus at the 10-o'clock position. No tissue was excised from this region.

It is not possible to state definitely the result of border-ray therapy in this patient. Clinically the tumor has not been controlled, and microscopically the cells do not appear to be completely destroyed. Inability to treat the entire lesion is regrettable, and complete cure by this method cannot be expected.

Stout maintains that Bowen epithe-

liomas are much less susceptible to X-ray and radium therapy than are basal and squamous-cell epitheliomas, and hence they would not be expected to respond to a less potent radiant force although its full effect is expended on the surface.

Sufficient radiation to destroy the tumor would almost certainly produce a radiation cataract and perhaps glaucoma secondary to radiation.

Since this lesion is so diffuse, the patient so difficult to handle, and the expected rate of progress of the lesion so slow, it has been decided to observe this lesion and do nothing more unless metastasis or definite invasion occurs.

Case 2. J. M., a colored female, aged 67 years, gave a history of injury to the right eye by a calf's horn 14 years prior to admission. She had had recurrent attacks of redness and pain since that time.

Vision was reduced to perception of light. There was a fairly dense leucoma of the cornea with blood vessels growing in from the limbus. Between the 5- and 9-o'clock positions there was a pinkish-gray, slightly elevated area. The possibility of Bowen's disease was suggested by Dr. A. B. Reese because the heaping-up of the corneal epithelium resembled that seen in case 1. Transillumination was clear (fig. 5).

Microscopic Report: About three fourths of the surface of the cornea was covered by a slightly elevated epithelial tumor which appeared to arise at each limbus and to extend centrally. The two areas of hyperplastic epithelium ended abruptly with normal corneal epithelium between them, and normal conjunctival epithelium peripheral to the limbus. There was no surface keratinization. The cells comprising the new growth lacked orderly arrangement. Bowman's membrane had been destroyed and replaced by a thick layer of highly vascularized pannus which was heavily infiltrated by inflammatory cells. At no point was the basement membrane of the epithelium broken to allow local invasion by the new growth. The epithelial cells varied in size. Some of them were monster cells with clumped nuclei in the center. Mitotic figures were infrequent. The cellular changes in the intraepithelial tumor were characteristic of so-called Bowen epitheliomas.

Case 3. This specimen was sent to the laboratory by Dr. R. L. McDaniel of Jacksonville, Florida, who has granted permission for this case report.

J. F., a white female, aged 87 years, was first seen in August, 1939. Vision of the left eye was limited to ability to count fingers at two feet.

Examination showed a chronic blepharoconjunctivitis, more marked on the left side. The cornea of the right eye was clear except for arcus senilis; that of the left eye was cloudy and there were areas of vascularization and grayish infiltration nasally, above and below. The lenses showed incipient cataracts. Tension was 19 mm. Hg (Schiötz) in each eye.

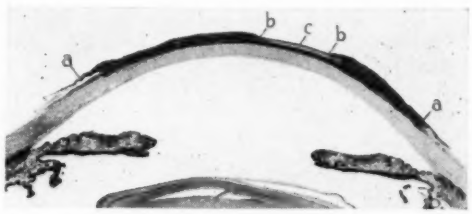

Fig. 5 (McGavic). Case 2: Microscopic appearance of a corneal tumor. Note the abrupt transition from normal epithelium to tumor, a, at the limbus and at b, centrally. Between the epithelium and Bowman's membrane there is marked cellular infiltration, c, in a pannus.

In April, 1940, the patient complained of itching and burning and extreme sensitivity to light, with intermittent neuralgic pain in the left eye.

Examination showed the bulbar conjunctiva to be inflamed and studded with many newformed vascular buds. A 3-mm. wide area of conjunctival thickening, with many vascular buds, was present around the limbus. The outer edge of this thickened epithelium could be elevated from the conjunctiva and appeared to arise from the limbus. The cornea was more vascularized and stained more diffusely with fluorescein than on examination eight months previously.

A specimen for biopsy was taken from the thickened conjunctiva and examined by two pathologists who made a diagnosis of benign papilloma from a very small piece of tissue which did not show any tissue beneath the epithelium. The globe was finally enucleated because it was very painful and almost blind. The following description was made from the cornea of the enucleated eye.

Microscopic Report: Arising in the epithelium at both upper and lower limbi and extending over two thirds of the surface of the cornea was a neoplasm made up of epithelial cells. The tumor was entirely within the epithelium and showed no tendency to invade the cornea or sclera at any point. The tumor was thickest at the limbus and became thinner near

the center of the cornea. The line of demarcation from tumor to normal corneal and conjunctival epithelium was abrupt. In some sections, the neoplastic tissue extended to the cut edge of the section. The epithelial cells had proliferated so that layers of cells were no longer demonstrable. There was a little hyperkeratosis of the surface layers. The cells were hypercromatic and varied widely in size, shape, and staining characteristics. Mitotic figures were easily found, averaging two per high-power field. Intercellular bridges were present. Some of the cell nuclei were clumped together and a

Fig. 6 (McGavic). Case 3: Microscopic appearance of a corneal tumor which is thickest at the limbus, a, on each side and thinner as it approaches the normal epithelium in the center of the cornea, b. The edges of the tumor are sharply demarcated, c and d.

few monster cells were present. The tumor was infiltrated by lymphocytes and polymorphonuclear leucocytes. At each limbus there was marked vascularity of the tumor. Bowman's membrane was partially replaced by a vascularized connective-tissue pannus which was infiltrated by inflammatory cells. At no point was there a break in the basement membrane of the epithelium. This tumor of the cornea was a diffuse intraepithelial epithelioma in which the cellular changes were characteristic of Bowen's disease (fig. 6).

Case 4. This specimen was sent to the laboratory by Dr. Donald Tinkess of Greenwich, Connecticut, who has granted permission for this case report.

N. R., a white female, aged 67 years, presented herself at the Clinic because of bleeding from the right eye. She had noted a tumor mass on the eye for less than two years.

Examination showed a large, fleshy, firm mass adherent to the upper part of the cornea and adjacent structures. There were a great number of tiny capillaries on the surface of the tumor, and blood was coming from these vessels.

Microscopic Report: The corneal epithelium was profoundly altered. While preserving its normal architecture, it was very greatly thickened and the rete pegs were much wider and deeper than normal. It was no longer possible to identify the normal layers because the individual cells had changed their appearance so that they resembled cancer cells with hyperchromatism and large nucleoli. Mitoses averaged one in every two or three high-power fields. Some bizarre monster cells had been formed, and in some of these several nuclei were clumped together in the center in the fashion characteristic of Bowen's "clumping cells." The basement membrane was intact, and there was a marked inflammatory-cell infiltration of the papillary and subpapillary layers. As one approached one side of the cornea, the proliferation became more active with a higher mitotic rate, and the tumor gradually invaded the bulbar conjunctiva and assumed the characteristics of an ordinary well-differentiated squamous-cell epithelioma.

This is a case in which the corneal epithelium shows the characteristics of mucosal Bowen's disease with a transition into squamous-cell epithelioma at one margin. I have seen the same changes occur in Bowen's disease of the face and of the glans penis (Dr. A. P. Stout).

The large tumor mass was a definite squamous-cell epithelioma. The characteristic cellular changes of Bowen's disease were less marked than in the other three cases. The specimen demonstrates that a portion of a Bowen epithelioma can progress into a larger tumor which is scarcely distinguishable from an ordinary epithelioma. There is no invasion of underlying tissue here, however, while an ordinary epithelioma usually invades long before the fungating portion reaches this size.

Case 5. This case is reported through the courtesy of Dr. Derrick Vail and Dr. Mary K. Asbury.

C. A., a white male, first consulted Dr. Vail in January, 1937, complaining of a weak and watering left eye. He had been treated for some years previously by another ophthalmologist who had advised that he quit his job in a paper factory because of the possibility that his eye was being irritated in his occuption.

In 1928 the cornea of the left eye had been burned, and in 1931 it developed an ulcer. On examination in 1937 vision of the left eye was 20/200. The eyeball was inflamed, and there was marked epiphora. The lacrimal apparatus was normal. There was a larger soft, vascular infiltration of the cornea, and the entire cornea stained with fluorescein.

The patient was not seen again until January 31, 1941. At this time the left eye was in much worse condition and markedly congested. The

involvement of the cornea extended from the 1- to the 5-o'clock position at the limbus and centrally 2 mm. within the pupillary area. The slitlamp picture suggested a keratocele with gelatinous excrescenses and multiple new capillaries.

An epithelioma was suspected by Dr. Vail because of the appearance of the lesion and because the condition was so resistant to treatment.

I am indebted to Dr. Vail for supplying a very complete history, a clinical description of the eye condition, and a sketch of the patient's eye. The specimen was prepared at the Holmes Laboratory under the direction of Dr. Asbury, who has been kind enough to send me several sections of the eyeball for study.

Microscopic Report: Extending in from the temporal limbus and covering two thirds of the surface of the cornea there was an epithelial tumor. At the limbus there were papillary projections downward without violation of the basement membrane. At this site there was marked proliferation of the epithelium forming a smooth-surfaced elevation. Elsewhere the tumor was flat. Throughout its entire extent the neoplasm was confined to the epithelium, which in places was in contact with Bowman's membrane; but there was a loose connective-tissue pannus between most of the tumor and Bowman's membrane. This tissue was heavily vascularized and showed moderate infiltration by inflammatory cells.

The epithelial cells had lost their usual orderly arrangement at all levels. Mitotic figures were present and were abnormal. Clumping of nuclei was very well demonstrated, and there were a few cells with very large nuclei. The usual epidermoid features of squamous-cell carcinoma were lacking.

The neoplasm was sharply demarcated from the normal conjunctiva beyond the limbus, and less definitely from the normal corneal epithelium nasally.

This is a typical example of a Bowen epithelioma involving the cornea.

Treatment

It is generally agreed that the optimum treatment of Bowen's disease is complete surgical excision. Removal of a portion of the tumor for biopsy has not been found dangerous. Radiation therapy is thought to be contraindicated by some pathologists. Treatment with chemicals or the actual cautery is considered inadequate and possibly dangerous, inasmuch as they may augment malignant change.[8]

Since the lesion shows little tendency to extend deeply, removal of small lesions by excision is not difficult and should be productive of very little scarring. A lesion on the cornea alone can be stripped away from Bowman's membrane, as described in case 1, where clear cornea remained after removal of the pannus-neoplasm. If the lesion extends diffusely over the conjunctiva, complete excision may require enucleation, and, if the palpebral conjunctiva is involved, possible loss of the eyelid. Excision of conjunctiva alone may be adequate, but symblepharon is likely to follow. Since the lesion is so slow in showing malignant manifestations, it might be considered safe to excise as much of the lesion as possible at one time and, after epithelization, to excise the remaining portion at a second operation. Careful microscopic study of the excised tissue will reveal the adequacy or inadequacy of removal of the neoplasm as there is usually a sharply demarcated line between normal and neoplastic epithelium.

In case 1, excision of the corneal portion of the tumor was successful, but border-ray therapy over the palpebral and bulbar conjunctiva did not entirely eradicate the tumor in this area.

Whatever its origin, and despite its long duration *in situ* without showing invasion or metastasis, Bowen's disease is a potentially malignant neoplasm and should be so considered in outlining the treatment. One can temporize more here than with true basal or squamous-cell epitheliomas, but finally the lesion must be entirely destroyed or it may become more than local in its importance.

Summary

1. Bowen's disease is an intraepithelial epithelioma which shows lateral spread *in situ* and is very slow to invade or metastasize. The histopathologic picture var-

ies from ordinary epithelioma *in situ* to Bowenoid epithelioma.

2. The diagnosis depends upon microscopic examination, but may be suspected clinically.

3. Complete surgical excision is the treatment of choice. Inadequate treatment by radiation, cautery, or chemical application is to be avoided.

4. Ocular involvement by Bowen's disease is here reported for the first time.

I wish to express my appreciation to Dr. A. P. Stout for his generous help and advice in the preparation of this paper.

The photomicrographs were prepared by Mr. N. E. Ross.

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SEX-LINKED HEREDITARY NYSTAGMUS*

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Congenital nystagmus is not uncommon and frequently occurs in individuals with marked diminution of vision in both eyes since birth or early childhood or in association with microphthalmia, congenital cataract, and corneal opacities. It is regarded by some authors as due to a faulty retinal image with consequent impairment of fixation.[1] Congenital nystagmus without associated gross visual disturbance occurs much less frequently and is usually due to some inherent defect or disturbance of those centers of the central nervous system which control associated ocular movements. This latter type of nystagmus has important hereditary aspects. In most of the family groups with hereditary nystagmus which have been reported, the ocular movements were associated with head nodding, and the inheritance was, as a rule, continuous and was not sex linked.[2, 3, 4, 5, 6, 7, 8, 9, 10, 11]

The inheritance was discontinuous in only a very few families, the disorder being transmitted by unaffected females to males.[12, 13, 14, 15] The authors wish to report another family with nystagmus of the latter type.

Case reports

First Generation

The father (Ia) died in advanced years and was free of any neurologic disorder. The mother (Ib) was healthy throughout life except for migraine which occurred during the pregnancies for the two youngest children, who were the only affected members of this generation.

Second Generation

Three elder sisters (IIa, IIb, IIc) are now in advanced years and show no evidence of any heredo-degenerative disorder of the nervous system. Their descendents, both male and female, in the succeeding two generations also remain asymptomatic.

The elder son (IId) was apparently well until the age of four years. A progressive neurologic disorder began at this age and was characterized by horizontal nystagmus, "spasms" of the extremities, and marked impairment of gait. The disease was apparently fully developed by the age of 9 years, and the patient remained an invalid until his death at the age of 51.

The younger son (IIe) was one of the informants. Since birth he has had a marked nystagmus, but careful neurologic and psychiatric examination revealed no other nervous or mental abnormality.

Third Generation

The younger son, noted on the chart as IIe married a woman whose family history was said to have been entirely normal. By this union there were five children, four girls and one boy, all of whom are normal.

Fourth Generation

The eldest sister (IIIa), who is married to a man with a negative family history, has five children, two girls and three

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boys. The daughters (IVa and IVd, aged 17 and 11 years, respectively, and the son (IVb), aged 16 years, are apparently normal. The remaining sons (IVc and IVe), aged 15 and 9 years, respectively, have a marked horizontal nystagmus, but no other neurologic signs or symptoms.

The second sister (IIIb) has had four children. Her daughter (IVf), aged 18 years, is normal and the second daughter, who lived only 14 days, so far as we know had no neurologic disorder. A son (IVh) has had marked nystagmus since birth and is mentally retarded.

The youngest son (IVe) has neurologic findings such as marked nystagmus, probably right inferior oblique palsy, intention tremor, and asynergia of the right arm which strongly suggest hereditary cerebellar ataxia. However, it would be difficult to place this diagnosis upon a definite basis.

Another sister (IIIc) has two children, a son aged 12 and a daughter aged 10, neither of whom has any neurologic findings.

The only male (IIId) in the third generation is neurologically negative. He has refused to have children, fearing the probability of an hereditary disease.

The youngest female sibling (IIIe) in the third generation has two children. The son (IVi), aged 10, has nystagmus, compound hyperopic astigmatism, and an inconstant vertical tremor of the head. The daughter (IVm), aged three, is as yet free of neurologic changes.

None of the members of this family show any characteristics of albinism, as is so frequently seen in the more common types of congenital nystagmus. The girls appear to be well adjusted, alert, active

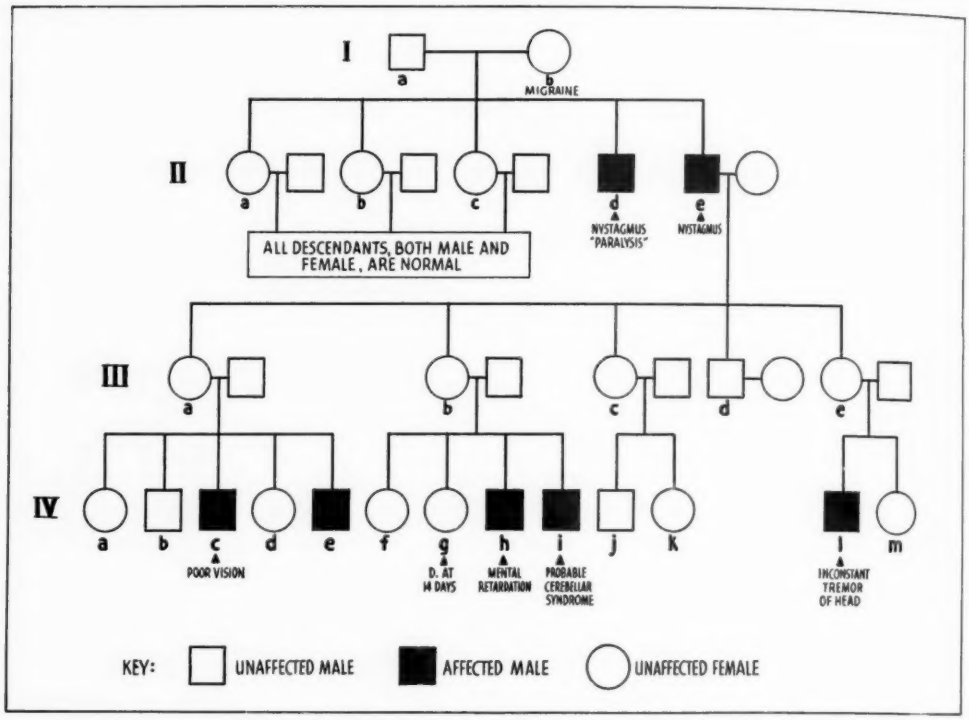

Fig. 1 (Waggoner and Boyd). Genealogic table of family with sex-linked hereditary nystagmus.

individuals, but the boys with neurologic symptoms are shy, backward, and ill at ease.

Summary of the Family History: According to several informants in the second generation the nystagmus began suddenly in this sibling generation. The disorder has shown various degrees of involvement in different members of the family. The first to be affected (IId) appeared normal until the age of four years, but then rapidly developed an incapacitating neurologic disorder with nystagmus, ataxia, and difficulty in locomotion. This condition was diagnosed as hereditary nystagmus and heredo-familial ataxia. Although there was typical nystagmus, the diagnosis of hereditary ataxia could not be positively made because of the inconclusiveness of the clinical picture. All other afflicted members of the family showed nystagmus at birth, and this was associated with other stigmata such as defective vision, mental deficiency, probable cerebellar involvement, and inconstant vertical tremor of the head. The presence of such and other anomalies has been reported in a family with a similar heredo-degenerative disorder.[16,17]

Comment

According to some authors[15] hereditary nystagmus shows at least three modes of inheritance. The most common type is as an irregular dominant involving both sexes. Numerous examples of this type have been reported.[15] Hereditary nystagmus with ambi-sexual occurrence appearing as a simple recessive has been observed less frequently, and consanguinity has been considered an important etiologic factor.[7] Neither of these hereditary patterns can explain the disorder in the family here reported. In this group the inheritance was discontinuous and the defect apparently was sex linked, since no neurologic disturbance has occurred in any of the female members of the family. This suggests that the third mode of inheritance was operating in this family and that the disorder was due to a sex-linked recessive factor.

Hereditary nystagmus is regarded by some writers[3,4,9,18,19] as evidence of a heredo-familial degenerative diathesis. Such heredo-degenerative disorders are usually not inherited in pure form.[20] Frequently there are variations in the defect in different generations or even in members of the same generation,[16] for, as pointed out by Sachs, "We must not draw the lines of a hereditary disorder too close. Variations from type are almost certain to appear." Most of the older case reports do not mention associated neurologic disturbances, but in many cases only one or two members of the family were examined and in others no neurologic examination was recorded. More recent and thorough studies emphasize the frequency of associated defects of the central nervous system.[3,4,9,17,19,21]

The presence of these associated neurologic disturbances brings up the question as to whether the nystagmus is a clinical entity or an abortive form of some other type of heredo-degenerative disorder. It is possible that hereditary nystagmus might be allied in some way to the heredo-ataxias and might represent an abortive form of this group.[17] In this family the involvement of the cerebellum in one or possibly two cases suggests such a relationship. While this suggestion is based on relatively few observations, it is further supported by the report[22] that in certain families with heredo-ataxia a nystagmus may be the only sign of involvement in some members. If there is any validity in this suggestion, it would indicate a close relationship between this family group and one with sex-linked hereditary ataxia which has been reported recently.[23]

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OPHTHALMOLOGIC FINDINGS ON DRAFTEES FROM THE WASHINGTON, D.C., MILITARY AREA*

PRELIMINARY REPORT

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This report is made purely as a statistical study of the men called up by the Selective Service Act and referred to Medical Advisory Board A because of ocular abnormalities over a period of four months. It can in no way be considered conclusive, but can be of definite value from a scientific standpoint by showing the trend of eye conditions among a large percentage of our youth of military age.

During the period from February, 1941, when the medical advisory boards were established, through May, it had been my privilege to have charge of examining all the young men referred from the local draft boards to Medical Advisory Board A because of eye conditions that required further study. This often entailed reclassification of many of the men sent to us for reëxamination.

These examinations have brought to light a wealth of pathologic conditions, which will be found listed in the accompanying tables, and represents a fair cross section of pathologic diagnoses.

It was apparent, as a purely personal impression, that a large percentage of the men examined desired military training; many considered it as a necessary duty and obligation to their country, and only a very small number were definitely antagonistic to military service. The large percentage accepted service as a necessary sacrifice toward protection of our way of life even though it entailed great personal sacrifices in many instances.

During the period from November 1, 1940, to May 1, 1941, 13,280 men were examined by the various hospital units. Of the number examined, 593 were inducted into military service. Twenty-eight men were rejected at the induction stations because of visual defects, or only 1.19 percent for the months of March, April, and May. During the same period 569 men were examined by the three Medical Advisory Boards, of which 223 were examined by us of Board A. It is quite encouraging to notice the very low percentage of rejections for ocular defects alone. Furthermore, some of these men undoubtedly were rejected at the induction centers without having been seen previously by the Medical Advisory Boards. There is, however, no available check-up on this fact at the present time.

Of the 223 men examined by us, 89, or 39.9 per cent were classified as 1A, or available for general military duty; 92, or 41.2 percent were classified as 1B, or available for limited military service; and 42, or 18.3 percent were disqualified for military service or put in class 4. Of the 223 men seen over this period, only 21 (9.4 per cent) were colored.

According to MR-9 (Army Regulations for Selective Service) the following are the visual requirements for the three classes:

MR 1-9 Visual Requirements:

CLASS 1A

(a) Normal vision; (b) 20/100 each eye without glasses, if correctible to 20/40 bilateral with glasses; (c) If vision is correctible to 20/40 bilateral, registrant need not wear glasses to be placed in 1A

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(amendment); (d) Conditions due to iridectomy or other operation upon the eye, if the condition for which the operation was performed has been relieved and the vision is within or above the minimum standard requirements; (e) Slight nystagmus; (f) Slight conjunctivitis; (g) Chronic simple conjunctivitis occurring in regions where trachoma is not prevalent and if easily remediable; (h) Slight adhesion of the lids to the eyeball; (i) Small pterygium; (j) Strabismus which does not interfere with vision; (k) Color blindness; (l) Exophthalmos if not of such degree as to have led to, or threatened, corneal ulceration and provided hyperthyroidism is excluded.

TABLE 1

OCULAR FINDINGS IN 223 DRAFTEES

Defect	No.	Percent
Myopia (simple)	58	26
Compound myopic astigmatism	97	43.5
Hyperopia	9	4.0
Hyperopic astigmatism	1	
Compound hyperopic astigmatism	20	9.9
Mixed astigmatism	3	
Squints:	16	7.17
Comitant esotropia, 7		
Alternating esotropia, 1		
Exotropias (comitant), 2		
Exotropias (alternating), 4		
Right hypertropia, 2		
Color blindness (total)	1	
weakness (red-green)	16	7.13
Amblyopia ex anopsia	31	13.4
Amblyopia (congenital)	7	3.13
Anisometropia	30	13.4
Aphakia (traumatic)	1	
Leucoma adherens	1	
Nystagmus	1	
Corneal scars	9	4.0
Iridodialysis	1	
Conjunctivitis (chronic catarrhal)	2	
Pterygium	1	
Blepharitis marginalis	1	
Anterior synechia	2	
Heterochromia iridis	1	
Vitreous opacities	2	
Visual nystagmus	4	
Subluxated lens	1	
Corneal dystrophy	1	
Marfan's syndrome	1	
Congenital cataracts	2	
Chorioretinitis	3	
Cataracts, complicated	1	
Iritis	2	
Macular hemorrhage	1	
Rupture of the retina	1	
Central chorioretinitis	1	
Anisocoria	1	
Anophthalmos	1	
Homonymous hemianopia (left)	1	
Medullated nerve fibers	1	
Convergence insufficiency	1	
Congenital malformation of the macula	1	

CLASS 1B

(a) A minimum vision of 20/400 in each eye without glasses, if correctible with glasses to 20/40 in either eye; (b) If a man's vision is so poor as to be 20/400 in each eye without glasses, if either eye is correctible to 20/40 with glasses and he may have loss of one eye or blindness in one eye if vision in other is not less than 20/40; (c) Loss of one eye or blindness in one eye not due to progressive organic change, with vision in the other eye of not less than 20/200 correctible to not less than 20/40; (d) Superficial corneal ulcer, provided acceptance is deferred until ulcer is healed without disqualifying impairment of vision; (e) The following conditions if mild: (1) Chronic conjunctivitis, not trachomatous; (2) Inversion of eyelids; (3) Eversion of eyelids; (4) Ptosis interfering with vision; (5) Epiphora; (6) Trichiasis; (7) Chronic blepharitis; (8) Extensive pterygium; (9) Chronic dacryocystitis; (10) Blepharospasm; (11) Diplopia due to paralysis of ocular muscles of one eye, if mild.

CLASS 4

Defects such as the following: (a) Vision less than the minimum requirements for special and limited military service; (b) Disfiguring cicatrices of the eyes; (c) Lagophthalmos, if associated with signs of hyperthyroidism; (d) Pronounced exophthalmos; (e) Chronic keratitis; (f) Chronic recurrent inflam-

TABLE 2

CLASSIFICATIONS AND REJECTIONS

Total number of men examined from November 1, 1940, to May 1, 1941	13,280
Total number of men referred to Medical Advisory Boards	569
Total number of Class 1A	152
Total number of Class 1B, and Class 4	417
Total number sent to Medical Advisory Board A	223
Total number of Class 1A	89
Total number of Class 1B	92
Total number of Class 4	42
Number of men sent for induction in March, 1941	1,884
Number of men rejected for visual defects	13
Number of men sent for induction in April, 1941	640
Number of men rejected for visual defects	9
Number of men sent for induction in May, 1941	561
Number of men rejected for visual defects	6

matory disease of the globe; (g) Deep ulcer of the cornea; (h) Any active disease of the retina, choroid, or optic nerve; (i) Detachment of the retina; (j) Marked nystagmus; (k) Glaucoma.

By reference to the tables it is seen that by far the largest number of men were referred because of myopia, myopic astigmatism, or compound myopic astigmatism. This myopia was usually of a high degree, 3 diopters or over. Only 9 men had hyperopia and 20 had hyperopia with astigmatism. One man was totally color blind but 16, or 7.13 percent, were red-green weak. This runs considerably higher than is recorded as the accepted general average for the male population, but is explainable on the basis of the associated pathologic conditions that produce an acquired color blindness. In testing color vision both the A-O pseudo-isochromatic color charts and the Holmgren Yarns were used.

One interesting fact is the almost total absence of any malingering on the part of these draftees seen by us, as far as vision alone is considered. Only three men made an attempt at feigning poor vision.

In quite a number of cases, the strict interpretation of the visual requirements, as set forth in the Army regulations, has been disqualifying men desirous of military training because of a very slight visual variation from the minimum requirements. This has now been recognized by the authorities, and we feel certain that as the obvious imperfections of so gigantic a scheme are ironed out a little more latitude will be permitted in the interpretation of these requirements. This will not exclude many men, desirous of military training, because they happen to fall one or two letters below the minimum visual requirement without glasses. Some latitude is already being permitted the Medical Advisory Boards in this respect.

Naturally with a project so immense as the creation of an army of several million men, this report is only a very small representation. However, as the months pass and our national defense speeds up, it will be most interesting to compare our findings with those from other sections of the country. This will afford a wealth of knowledge and information about the youth of our nation that nothing but a tremendous military expansion, such as this, would make available. From the individual's standpoint it will in many cases help prevent unnecessary and irreparable harm to vision through neglect.

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THE ROLE OF THE MEIBOMIAN GLANDS IN RECURRENT CONJUNCTIVITIS*

A REVIEW WITH EXPERIMENTAL OBSERVATIONS

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Contrasted with the other structures of the eye and its adnexa, the tarsal or meibomian glands have aroused relatively little interest if the scarcity of literature on the subject is indicative. The relatively infrequent articles in this connection are devoted almost solely to the chalazion, its pathology and its treatment; a few authors have mentioned the entity of acute meibomianitis, while textbooks dismiss the subject with "the internal stye." It is the purpose of this paper to deal not with acute meibomianitis or with chalazia, but with the meibomian glands in their relation to the conjunctiva.

Acute conjunctivitis is a familiar picture to every ophthalmologist, as is its treatment, yet conjunctivitis recurs frequently within a few months after the eye became asymptomatic. The same treatment is repeated, apparently effectively. After this has happened several times, the patient finally appears with typical manifestations of *chronic* conjunctivitis, a condition that is extremely stubborn to therapy and often almost hopeless to cure. It is not quite clear in the meantime what stimulates these annoying recurrences and what is happening in the interval between attacks. It is the opinion of the writer that a partial explanation of this condition is, in a majority of cases, to be found in the meibomian glands. In order to obtain information as to this possibility, 18 cases of conjunctivitis out of a relatively large series were chosen for observation; they were selected because of obvious clinical signs of inflammation, for control purposes, and others were included because they were apparently normal. In order that a clearer understanding may be gained of the role of the meibomian glands in recurrent conjunctivitis and thus eventually in chronic conjunctivitis, it may be useful to review their anatomy, physiology, and pathology.

ANATOMY

The tarsal or meibomian glands were first described by Meibomius in 1666, although they had already been suggested by Casserius in 1609. They are extraordinarily enlarged sebaceous glands imbedded in the tarsal plate and consisting of straight tubules from whose lumina acini open, each tubule opening finally in a single pore on the lid margin. The glands are long and narrow, and although their upper ends may be bent over, they are regularly arranged in a single row perpendicular to the free margin of the lid. They occupy almost the *entire thickness* of the tarsal plate, sometimes forming a series of ridges on its anterior surface and extending throughout its whole height and length; consequently they are tallest in the middle (upper-lid average, 7.05 mm.; lower-lid average, 3.95 mm.) and shortest at the extremities. They number approximately 38 in the upper and 28 in the lower lid (Hirose, 1939[1]). The tarsal glands represent the ordinary sebaceous glands of a primitive secondary range of eyelashes which have disappeared in man, a fact that explains the presence of a double row of cilia and the absence of these glands in cases of congenital dis-

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tichiasis (Brailey, 1906;[2] Stephenson, 1901[3]), and the aberrant lashes found in a cyst on the posterior face of the tarsal plate (Szily[4]). The acini grouped about the main duct of each gland are single or composite and number 30 to 40 in the longest gland (Sappey, 1867[5]). The acini are surrounded by a lymph space lined with endothelium (Parsons, 1904[6]), and the ducts are lined with cubical epithelium that becomes stratified at the mouth on the lid margin.

The connective tissue of the tarsal plate appears as a dense supporting stroma or "perimeibomian capsule" concentrated in front and behind the glands and connected by transverse strands passing between the acini. This stroma is, moreover, permeated by a system of lacunae as well as lymph spaces, and is traversed by a network of nerves and blood vessels supplying the glands. The elastic tissue is concentrated around the glandular acini, where smooth-muscle fibers are also present, and some fat cells are found in the borders of the plates, especially in the lateral convex border of the upper one (Virchow, 1905[7]). The deep surfaces of the tarsal plates are lined by the closely adherent palpebral conjunctiva (Whitnall[8]).

The relation of the horizontally disposed fibers of the pars ciliaris of the orbicularis oculi muscle to the terminal canals of the glands is interesting (fig. 1). The pars ciliaris is known as the muscle of Riolan, being separated from the palpebral portion of the orbicularis by the glands of Moll. One part of the muscle lies superficial, another part (subtarsal) deep to the meibomian glands; some minute bundles are even interlobular, interciliary, and retrotarsal in position. The muscle of Riolan is continuous medially with Horner's muscle, which arises behind the lacrimal sac from the lacrimal crest. The palpebral conjunctiva extends *as far as the glandular orifices* (meibomian), the rest of the border anteriorly being cutaneous (Wolff[9]).

Physiology

The meibomian glands are sebaceous glands, but the amount of their secretion is ordinarily so slight that only histo-

Fig. 1 (Scobee). Semidiagrammatic sketch of a vertical section through the upper lid, showing the relation of the muscle of Riolan, R, to the mouth of a meibomian gland.

chemical methods have been applied to investigate it. According to Pes,[10] the secretion contains mostly cholesterol mixed with a small quantity of fats and soaps, the saponification having been caused by the action of alkaline tears on fats. Buschke[11] increased the glandular production by means of eserine, thus obtaining a milky emulsion of fatty substance and tears; the same increase in secretion occurs with the use of pilocarpine and, according to Duke-Elder,[12] following cervical sympathectomy. Buschke observed the secretion as thick masses in the saccules of the ducts, and in the tubules as clumps of small, strongly refractive granules containing well-formed epithelial cells; the granules gave a partial

reaction for fat. After secretion, the swollen granules and cellular residue are well mixed, and Buschke believes that the meibomian glands produce a specific secretion that differs from the products of other modified cutaneous glands. Duke-Elder states that the secretion from the glands is made up of debris; the acini are filled with glandular epithelium consisting of cubical-shaped fat-free cells located peripherally and polygonal fat-laden cells located centrally. As this debris of fat-laden cells is extruded, cells are removed from the layers below, just as on the skin, to form more debris.

The secretion is called *sebum palpebrale* which by its greasy nature lubricates the lids and prevents their adhesion. The chief biological function of the glands is to secrete this fatty substance onto the lid margin to hinder the overflowing of tears. The glands are absent from the lacrimal part of the lid margin (punctum and lacus) and it is here that the tears, unless unusually abundant, first begin to trickle down (Krause[13]).

Secretion of the meibomian glands may be studied grossly. Massage of the lids, performed properly with the fingers, expresses sufficient material from the gland orifices for gross examination. With proper lighting, the material expressed reflects light and is readily visible, even though it is colorless. If the lids of every eye are massaged routinely, some will be found whose meibomian secretions are clear and glairy, which is considered the normal appearance; others will be found which manifest no symptoms, while material from their glands is straw-colored and oily, and this, also, must be considered normal. When, on the other hand, a true hypersecretion of the glands exists, the secretion is more yellowish than straw-colored and almost mucoid, while the glandular orifices on the lid margins appear to be covered with tiny caps. Where definite evidence of inflammation is present, the secretion assumes a purulent character. In the patients whose lids itch intensely but appear clinically normal, the secretion expressed is frequently whitish and rather cheesy.

Pathology

When the outlets of the meibomian glands become obstructed, meibomian cysts or chalazia may result, and this happens not infrequently (Friedenwald[14]). The histologic picture of the chalazion is quite characteristic and well known. The occurrence of infection in the glands is common in eyes subjected to constant strain and prolonged mechanical and chemical irritation. Congestion of the conjunctival membrane is a predisposing factor in the production of acute inflammation in these structures. Here, as in many other inflammations, one must consider two main factors as operative: (1) predisposition of the body to this type of infection, and (2) presence of an exciting agent, chemical or mechanical. Dust, smoke, chemical vapors—any of these if allowed to act upon the conjunctiva for a long enough time will establish a state of chronic congestion with a predisposition toward the formation of meibomian cysts or at least toward obstruction of the glandular orifices. The congestion that paves the way for an acute exacerbation is often caused by eyestrain from refractive errors, local irritation, or is a part of a systemic vascular stasis. Conjunctival congestion that precedes the more active inflammatory reaction of an acute meibomianitis in such cases is of the mild, passive type manfesting itself in symptoms that are mainly due to a hypersecretion of the glands (Gold[15]).

Experimental

In the 18 cases reported in this particular series, the following diagnostic procedure was utilized: The conjunctival

cul-de-sac was flushed thoroughly with 2-percent boric-acid solution and the excess wiped away with sterile cotton. The upper lid was then everted and a sterile cotton applicator rubbed firmly back and forth over the palpebral conjunctiva thus exposed until the area became reddened and some epithelial cells had been removed; this applicator was finally streaked over blood-agar plates. Next, the lid margins were grasped firmly between the thumbs and some of the meibomian-gland secretion gently expressed; the secretion was picked up by an assistant with a small sterile cotton applicator and this was likewise streaked upon blood-agar plates. At the end of 24 and 48 hours, colonies were observed grossly and smears made for microscopic examination. As stated previously, in every

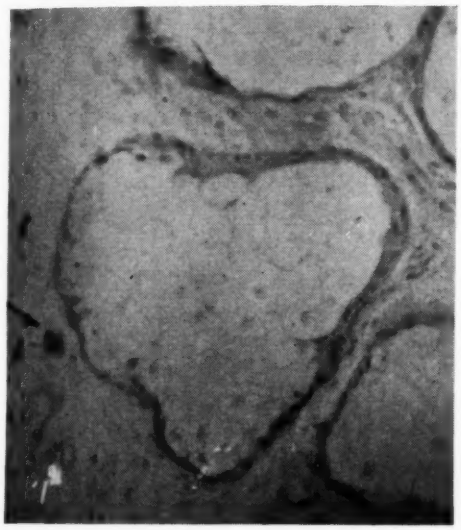

Fig. 2 (Scobee). Note the clump of staphylococci near the wall of the largest acinus in the field (low power).

case staphylococci were found in the cultures from the meibomian glands; all cultures were transferred from the plates to tubes of mannite broth in order to determine their potential pathogenicity according to the manner described by Julianelle (1935, 1937[16, 17]).

In five selected cases, after the consent of the patients was obtained, biopsy specimens of glands from apparently normal lids following recovery from conjunctivitis were taken. In these cases, *conjunctival cultures were negative yet meibomian-gland cultures were positive* for staphylococcus, while the lids had a normal appearance and the patients were asymptomatic. For the biopsy specimens, the following procedure was used: The upper lid was anesthetized by injection of 1-percent procaine to which adrenalin had been added, a chalazion clamp applied, and the lid everted. A vertical incision through the conjunctiva was made through which a vertical strip of tarsus some 2 to 3 mm. wide and 5 to 6 mm. long was removed. The lids thus incised healed nicely and quickly without undue scarring. The removed piece of tarsus containing about three meibomian glands was first fixed in formalin and sections were made from paraffin blocks; staining was with hemotoxylin and eosin for some sections and Gram stain for others. Using the oil-immersion lens, clumps of staphylococci could then be seen in the acini, and in

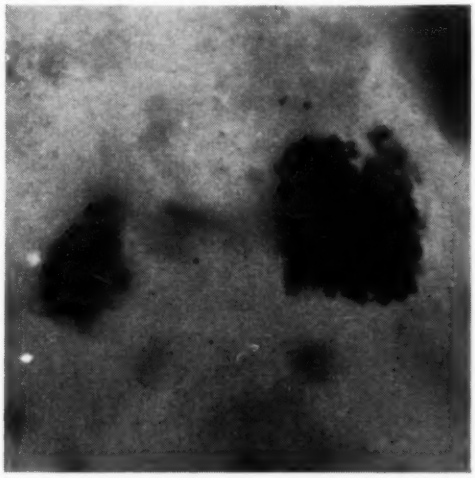

Fig. 3 (Scobee). Same group of staphylococci as in figure 2 under much higher magnification.

two cases the organisms apparently had ruptured through the wall of the acini into the surrounding meshwork of the tissue (figs. 2 and 3); staphylococci could be demonstrated in all of the five biopsy specimens. The following pathologic report upon the specimen illustrated (figs. 2 and 3) was given through the courtesy of Dr. Harvey D. Lamb:

> In a few places, a moderate degree of infiltration with small lymphocytes and plasma cells is present in the connective tissue in part of the circumference and between meibomian-gland acini. At one place, the limiting connective-tissue covering of an acinus is broken through and epithelioid and giant cells have developed as a reaction to secretion of the meibomian-gland acini. In the Gram-stained sections, clusters of staphylococci are seen in the acini, and also in the tissue between acini. This is an incipient chalazion.

Clinically, however, this was a normal-appearing lid with healthy, pink conjunctiva.

Treatment and Results

The treatment in all cases was fairly uniform. Cultures from the conjunctiva and meibomian glands were taken first at each visit. As long as the lids (conjunctivae) had a velvety-red surface, 1-percent silver nitrate was applied to the everted lids following anesthesia by instillation of 0.5-percent pontocaine. The conjunctival sac was then flushed with 2-percent boric acid. For home treatment, all patients were given 1:5,000 Zephiran (alba, aqueous) containing a few drops of 1:1,000 adrenalin to use as eye drops four times daily in the involved eye. The patients' lids were carefully massaged at each visit. Following cessation of all clinical signs of inflammation, patients were seen once a week for massage and culture until negative cultures from the meibomian glands could be obtained.

Of the 18 patients selected for this report (table 1), 9 had chronic conjunctivitis and 7 acute conjunctivitis; the remaining 2 had lids appearing clinically normal. Ages of the patients ranged from 6 to 72 years and no particular sex incidence was noted, even in a much larger series of cases. Bacteriologic diagnoses revealed 4 cases of hemolytic staphylococcus type A, 12 cases of hemolytic staphylococcus type B, and 2 cases of hemolytic staphylococcus types A and B. There would appear to be no connection between the types A or B and a clinical diagnosis of acute or chronic conjunctivitis; this observation was also true of a much larger series of cases. Of the cases of chronic conjunctivitis, the longest duration was 15 years, the shortest was 6 months. Of the cases of acute conjunctivitis, the duration varied from 24 hours to 2 weeks. The patients in all of the cases of chronic conjunctivitis gave a history of repeated flare-ups and remissions; all listed as having acute conjunctivitis were seen on the occasion of their first attack. Two patients whose lids were clinically normal complained of itching, while of these two, one had a slight blepharitis. One case of chronic conjunctivitis was associated with chronic dacryocystitis and the tear sac was removed; one case of acute conjunctivitis was the first infection of a senile ectropion, and the latter condition was treated with the Ziegler cautery. The treatment of these patients, both at home and at their periodic visits, has already been discussed.

All cases of acute conjunctivitis responded quickly and well to the treatment outlined, but it was found that in the average case cultures from the meibomian glands continued to be positive for staphylococci for an average of six weeks. The shorter the duration of the primary attack when treatment was first instituted, the shorter the necessary period of weekly massages was found to be. The patients in two cases of chronic conjunctivitis, although they had gained great symptomatic relief, voluntarily discontinued treatment after periods of two

TABLE 1

SUMMARY OF EXPERIMENTAL DATA ON PATIENTS WITH MEIBOMIANITIS

Case	Clinical Diagnosis	Bacteriol. Diagnosis	Duration	History	Treatment	Results	Biopsy
1	Chronic conjunctiv.	Hemolytic staph., A	6 months	Numerous flare-ups	Routine* and sulfathiazol	Temporary relief; 2 relapses since	Staph. clusters
2	Acute conjunctiv.	Hemolytic staph., A, B	3 days	Primary attack	Routine*	Massaged 2½ months; no recurrences	None
3	Chronic conjunctiv.	Hemolytic staph., B	5 years	Numerous flare-ups	Routine*	Massaged 7 months, more comfortable but lids look about same	Staph. clusters
4	Acute conjunctiv.	Hemolytic staph., B	5 days	Primary attack 3 months ago	Routine*	Massaged 2 months; no recurrences	None
5	Acute conjunctiv.	Hemolytic staph., A	8 days	Primary attack	Routine*	O.K. in 10 days; 6 weeks' massage; no recurrence in 8 months	None
6	Chronic conjunctiv.	Hemolytic staph., B	15 years	Numerous flare-ups	Routine*	Massaged 2 months; symptomatic improvement; stopped treat.	None
7	Acute conjunctiv.	Hemolytic staph., B	2 days	Primary attack	Routine*	O.K. in 5 days; 4 weeks' massage; no recurrence	None
8	Chronic conjunctiv.	Hemolytic staph., B	3 years	Numerous flare-ups	Routine*	Massaged 5 months; clinical cure; no relapse in 8 months	Staph. clusters
9	Normal conj. with itching	Hemolytic staph., B	2 years	One attack 2 years ago	Routine*	Massaged 4 weeks with relief of symptoms; no relapse in 10 months	None
10	Normal conj. Blepharitis	Hemolytic staph., A, B	1 year	Primary attack 14 months ago	Routine*	Massaged 2 months; no recurrences in 8 months	None
11	Chronic conjunctiv.	Hemolytic staph., A	8 years	Dacryocystitis for 8 years	Removal of tear sac and routine*	Massaged 2 months; no recurrences in 8 months	None
12	Acute conj. Senile ectrop.	Hemolytic staph., B	2 weeks	Primary attack	Ziegler cautery and routine*	Massaged 5 weeks; no recurrences in 6 months	None
13	Chronic conjunctiv.	Hemolytic staph., B	2 years	Numerous flare-ups	Routine*	Massaged 2 months; some relief; discontin. treat.	None
14	Chronic conjunctiv.	Hemolytic staph., B	4 months	Two flare-ups before this	Routine*	Massaged 3 weeks; no recurrences in 5 months	Staph. clusters
15	Chronic conjunctiv.	Hemolytic staph., A	1½ years	Numerous flare-ups	Routine*	Massaged 6 weeks; much improved; discont. treat.	None
16	Acute conjunctiv.	Hemolytic staph., B	24 hours	Primary attack	Routine*	Massaged 10 days; no recurrences in 8 months	None
17	Chronic conjunctiv.	Hemolytic staph., B	3 years (mild)	Infrequent flare-ups	Routine*	Massaged 11 weeks; no recurrences in 6 months	None
18	Acute conjunctiv.	Hemolytic staph., B	4 days	Primary attack 4 months ago	Routine*	Massaged 3 weeks; no recurrences in 6 months	Staph. clusters

* "Routine"—see explanation in text.

months and six weeks, respectively; all other patients were faithful in returning for weekly lid massage and all seemed convinced of the value of the treatment. In case 3, a patient with chronic conjunctivitis who had been treated for seven months was seen very recently (now nine months from his first visit) and, surprisingly enough, the thickening of the lids was noticeably decreased and the patient entirely comfortable.

Of the five patients chosen for biopsy, four had chronic conjunctivitis, the other an acute conjunctivitis following a primary attack four months previously. In every case, as previously stated, clumps of staphylococci could be found either within the glandular acini or in the tissue spaces about the acini. All biopsy specimens were taken during periods of remission of the condition when the lids had a clinically normal appearance.

Discussion

When the anatomy of the meibomian glands is considered—relatively long tubules from which sacculated acini project, resting as they do in a meshwork of loose connective tissue through which run endothelium-lined lymph spaces, blood vessels, and nerves with the whole enclosed in a dense capsule of tarsal plate—it requires no great feat of the imagination to see how quickly congestion of the lid vessels might simply by pressure obstruct either the entire tubule or many of its projecting acini. Furthermore, since the palpebral conjunctiva is closely adherent to the tarsal plate (through which the glands are plainly seen), it is easy to see how an acute conjunctivitis might bring about an inflammatory infiltration of this area around the glands. Add to this the fact that the palpebral conjunctiva actually extends all of the way to the orifices of the glands on the lid margin and the path of the etiologic organism of acute conjunctivitis into the meibomian glands is made clear.

It may be concluded from this that staphylococci, or other organisms, may find their way into the glands, there to take up a habitat and remain long after the acute conjunctival inflammatory episode has run its course. This is evidenced by the fact that organisms may be isolated from the glands following the subsidence of an acute conjunctivitis when conjunctival cultures are negative. It would almost appear that in many instances staphylococcus fulfills the role of a normal inhabitant of the glands or at least is of no pathogenic significance; yet, since staphylococcus is an opportunistic organism of potential virulence, capable of inciting infection as circumstances permit, its importance in the meibomian glands becomes apparent. Once in the glands, staphylococcus may multiply in the acini, and numbers of the organisms will then be constantly discharged upon the lid margin along with the sebum palpebrale to fall into the conjunctival cul-de-sac. Any factor leading to subsequent conjunctival congestion with a lowered conjunctival resistance may therefore precipitate a recurrence of the conjunctivitis. Such a cycle can occur only a limited number of times before the picture of chronic conjunctivitis becomes evident, with the thickened lids, reddened conjunctiva, excessive meibomian-gland secretion, and intense discomfort to the patient.

The problem, then, resolves itself into an attempt to rid the meibomian glands of staphylococcus (or other causative organism) following acute conjunctivitis; at best, this is more easily contemplated than achieved. Much can be accomplished by the use of repeated lid massage following an attack of conjunctivitis, accompanied by regular use of an efficient antiseptic eye drop. This is by no means the whole answer to the problem, although it will many times prove successful in cases in which there have not been too many recurrences; in other cases, however, it is of no avail, particularly if the lids have become thickened by newformed connective tissue. Lid massage does provide definite if only partial relief to sufferers with chronic conjunctivitis and should by no means be denied them.

The choice of an ocular antiseptic drop seems to matter little as long as it be an efficient one. In all of these cases, a 1:5,000 solution of aqueous Zephiran (alba) was used with satisfactory results; even though the drop be diluted several times with tears, it is still effective for staphylococcus (the commonest offender) in dilutions up to 1:35,000 and it is not rendered ineffective by the presence of albuminous secretions in the conjunctival sac. It is interesting to note that the addition of a small amount of 1:1,000 adrenalin to the eye drops seems definitely to improve natural meibomian-gland

drainage. This perhaps is not so strange as it might seem if the anatomy of the gland is recalled: in the first place, due to the length of the gland and its many acini, it will certainly not drain properly by the internal expulsive force of its secretions alone. There must, therefore, of necessity be some sort of "milking" action upon the gland through its surrounding tissues, as occurs when the eyelids are blinked. It seems probable that adrenalin, by its vasoconstrictor action, reduces the size of the congested lid vessels pressing upon the gland through its surrounding drainage—to allow unimpeded milking of the glands during blinking. The muscle of Riolan, placed as it is both before and behind the glands, with some of its fibers between acinar lobes, also probably plays an important part in the gland drainage. Admittedly, it is a striated muscle and any conceivable effect of adrenalin upon it would be difficult to determine, but nevertheless it provides an interesting subject for speculation. The fact remains that patients who use eye drops to which adrenalin has been added require much less frequent lid massage, and the material expressed from their glands by massage more closely resembles the "normal" than occurs when adrenalin is not used. This can be demonstrated by substituting plain antiseptic drops without adrenalin for those with adrenalin during the course of treatment, meanwhile giving lid massages at three-day intervals. In the majority of cases, the change in character of the meibomian secretion is easily and readily apparent.

With further regard to a possible milking action of blinking upon the meibomian glands, it has been noted in several cases of paralysis of the seventh cranial nerve as well as in senile ectropion that the glands almost invariably contain a thick yellowish or whitish secretion. This can be attributed, it is felt, to the absence of the blinking of the lids and thus to the loss of an adjunct to glandular drainage.

The facts presented in this paper are, for the most part, fairly well known or at least suspected, and it is hoped that they will perhaps stimulate thought toward a solution of the problem discussed, which has for its ultimate goal the relief of patients with chronic conjunctivitis.

Conclusions

(1) It is a short, direct route from acute staphylococcal conjunctival infection to meibomian glandular involvement; this almost invariably happens.

(2) Staphylococci in the meibomian glands play a prominent part in recurrent conjunctivitis; if they are not eliminated from the glands, they eventually lead to chronic conjunctivitis.

(3) Lid massage, repeated weekly, in addition to continued use of antiseptic eye drops for four to six weeks following the cessation of an acute conjunctivitis, will accomplish the removal of staphylococci from the meibomian glands.

(4) Addition of adrenalin to antiseptic eye drops promotes drainage of the meibomian glands.

(5) Regularly repeated lid massage gives great symptomatic relief to patients with stubborn chronic conjunctivitis.

The author wishes to express his thanks to Dr. Edward Griffey, who first brought the idea for this work to his attention, and to Dr. Lawrence T. Post, through whose courtesy patients were made available for the work; also to Dr. Harvey D. Lamb for the pathologic report quoted and to Dr. L. A. Julianelle for his kind advice and helpful criticism.

640 South Kingshighway.

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CATARACT EXTRACTION AFTER GLAUCOMA OPERATION*

JOHN M. McLEAN, M.D.
New York

The purpose of this note is to report a satisfactory technique for dealing with cataracts in the presence of functioning external filtering operations for glaucoma. The necessity for cataract extraction in any eye that has an adequately draining bleb from trephining, iris inclusion, or other similar operation for glaucoma presents a definite problem. Some surgeons prefer to make a classical cataract incision, even though it may destroy the effects of such previous operation. Others attempt to preserve the draining bleb by performing the cataract extraction laterally or even below. Still others elect to make unsutured sections in clear cornea anterior to the draining area. All of these methods have obvious disadvantages, particularly in glaucomatous eyes.

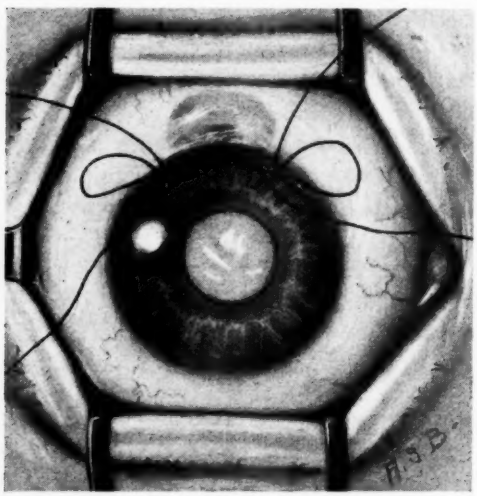

Fig. 1 (McLean). Sutures placed before section.

It seemed therefore desirable to perfect a technique that would assure firm wound closure with maximum safety and minimum risk of impairing function of the previous operation. In the author's hands a technique slightly modified from his suture for ordinary cataract operation[1] has been quite satisfactory.

Two small perpendicular incisions are made in clear cornea to about half thickness. These incisions are placed to either side of the site of the glaucoma operation and just far enough forward so that the cataract section on emerging through

* From the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital and University.

these incisions will conveniently clear the filtering area. A silk suture on a Kalt corneal needle is placed through the lips of each prepared slot and the central portion of the suture withdrawn and laid aside to make room for the cataract knife

By this method firm and safe closure of the cataract section is obtained without risk of impairing the previous glaucoma operation. To date four such operations have been performed by the author, three following successful corneoscleral tre-

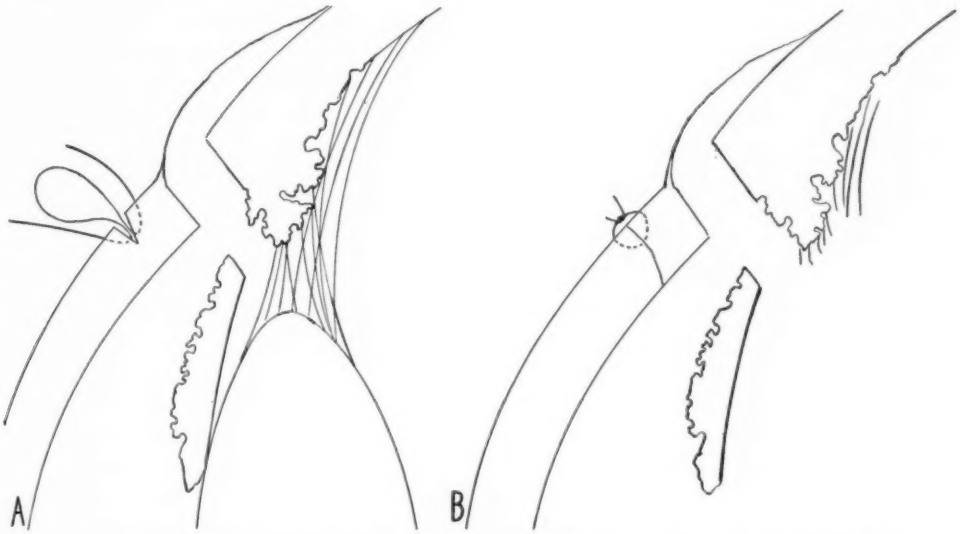

Fig. 2 (McLean). A, Cross-sectional diagram of suture before section. B, Cross-sectional diagram at end of operation.

(figs. 1 and 2 A). The two loops thus formed are placed out of the way, and an ordinary cataract knife is used to make a section starting in the classical fashion and emerging through these prepared slots and sutures. After the cataract is removed, preferably by intracapsular technique, the wound may be immediately and firmly closed by the two sutures (fig. 2 B).

phining and one after successful iridencleisis. In no case did any complication ensue, and in each the glaucoma continued to be controlled by the original operation. Similar operations have been performed by other members of the staff of the Wilmer Institute. All of these were equally satisfactory.

525 East Sixty-eighth Street.

Reference

[1] McLean, J. M. A new corneoscleral suture. Arch. of Ophth., 1940, v. 23, March, p. 554.

SYSTEMIC DISTURBANCES FROM ERRORS OF REFRACTION AND OF DIET

RAY M. MOOSE, M.D.
San Bernardino, California

This paper deals largely with the following 12 general symptoms that are commonly complained of by adult patients who come in for glasses: headache, feeling too tired, "touches of rheumatism," constipation, vague digestive complaints, nervousness, poor appetite, dizziness, disturbed sleep, feeling cold, skin disturbances, cold or sweaty hands.

It is common knowledge that these symptoms could be caused by eyestrain, directly or indirectly; or they may arise from other causes. The patient, however, with uncorrected refractive errors, is more inclined to think that relief will come with "a good pair of glasses." This idea, no doubt, arises in large measure from the observation that when the general disturbances are worse his local eye symptoms are worse. Therefore the patient is more keenly disappointed if his glasses fail to bring relief. Furthermore, in his state of nervousness, with digestive complaints, headaches, and sleeplessness, the patient is hard to please with the most meticulous refraction, if nothing but glasses is given.

Confronted with this situation the conscientious ophthalmologist thinks perhaps a focus of infection might be responsible for these disturbances. He searches for such a focus and finds that many complaining patients have neither teeth nor tonsils nor any evidence of a focus of infection.

Should the oculist now consider referring his patient to the family physician or the internist? Yes, in some cases; but 87 percent of my adult patients in this study had more than one of these disturbances, and some had already had physical examinations with negative findings.

There is one other line of inquiry that the ophthalmologist can make, and it is within his province there to apply remedial measures. He can study the food habits of these patients, put them on a corrected diet, and give vitamin concentrates to hasten recovery from any possible deficiencies. This procedure we have found to give such gratifying and at times spectacular results in individual cases that a plan was developed for making detailed observations that might be of statistical value.

MATERIAL AND METHOD

Plan and scope of work. With the help of a local internist[1] the following plan for making the observations was adopted: of 258 consecutive adult patients for whom glasses were prescribed last year, only 100 returned for check-up one or two months later, and these form the basis of this report. Detailed diet histories, in addition to clinical histories, were taken in all cases. To 50 of the patients, glasses, corrected diets, and vitamin concentrates were given, to the other 50 patients, used as controls, only glasses were prescribed. Nothing else was done for either group. The symptoms listed above were estimated as to the severity for each patient at the first office visit, and again one or two months later. In addition to the questions relating to the severity of the 12 symptoms above listed, objective observations were made at both visits on both groups as follows: blood pressure; condition of skin of face, hands, and arms; color and texture of nasal mucous membranes; degrees of coldness and moisture of hands.

Diet used. Instead of relying merely on

the usual optimum diet slip, certain principles were followed in trying to educate the patients in proper food selection. These principles are outlined briefly in the following instructions that were given with more elaboration to patients when their dietary habits were studied:

1. Eat meat, eggs, cheese, and drink milk for animal proteins.[2]
2. If you cannot take cheese or milk (4 glasses for the child and 2 for the adult) take calcium salts for the necessary calcium; for example, 2 level teaspoonfuls of dicalcium phosphate daily.
3. Eat fruits (for dessert) and vegetables, and the 100-percent grain foods for vitamins, minerals, roughage, and carbohydrates.
4. Avoid those foods that have had the vitamins and minerals largely removed in the "refining" processes, such as white flour and cane sugar and the innumerable sweets and pastries made from them.
5. Avoid overeating, especially when changing the diet.

Vitamins used. Four teaspoonfuls daily of Galen B or Squibb's vitamin B and G syrup were prescribed routinely, supplying according to the literature of each firm, 3 mg. B_1, 200 gammas of B_2, 3 mg. of B_6, 40 mg. of nicotinic acid, 8 mg. of pantothenic acid, and filtrate factor (J.-L.) value 560.[5] Also two plain halibut-liver oil capsules were prescribed, supplying daily 20,000 units of vitamin A and 340 units of vitamin D.[6]

Results

Report of observations. Charts 1 to 12 present the summarized record of the frequency and severity of the symptoms encountered in all the patients. The left half of the circle shows that both the control group (that is, the patients given glasses only) and the treated group (those given glasses, diets, and vitamins) had about the same distribution of symptoms. The right half of the circles shows that the severe symptoms, except constipation, have been markedly reduced among the 50 treated patients; that is, among those given glasses, diet, and vitamins. Only in the circle of headaches have the glasses alone produced a decided effect. This drop in severity and frequency of symptoms is shown by estimations to be 61 percent for the treated group.

Data from the Diet Histories: The detailed diet histories of these patients revealed the same types of major dietary errors as made by a group of patients studied previously,[7] namely:

1. Low intake of milk and cheese. Sherman[3] says that this usually means low intake of calcium. Twenty-eight percent of these patients with refractive errors were found to be taking none to three glasses of milk per week.
2. Deficiency of animal protein from low intake of milk, cheese, eggs, and meat.
3. Excess bread, sweets, and pastries from white flour and cane sugar. In fact nearly half of the total calories came from these devitalized foods, foods not only comparatively free from vitamins, but deficient in iron and other minerals.[4]

Blood-pressure Findings: To serve the purpose of a dividing line, all patients with blood pressure below 150 systolic and 100 diastolic have been designated as normal, and all at that level or above as abnormal, or high blood pressure, regardless of age. On that basis 25 of the 100 patients had high blood pressure at the first visit, 14 among those to be treated, and 11 among the controls. The changes that took place one or two months later

TABLE 1

25 PATIENTS WITH HIGH BLOOD PRESSURE. FINDINGS ONE OR TWO MONTHS AFTER FIRST VISIT

Condition	Treated	Controls
Better	3	4
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Normal (cured)	9	4
Total	14	11

are recorded in table 1. The changes were not conclusive but suggest some improvement in the treated group.

Other Objective Findings: Changes in condition of skin, and degree of coldness and perspiration of hands were found to parallel reports given by the patients (charts 3 and 4). Changes in color and texture of mucous membranes of the nose were not definite enough to be observed.

DISCUSSION AND CLINICAL APPLICATION

"The symptoms of disorder in the general nervous system that may be due to efforts to compensate for refractive defects cover a wide range of general symptoms that also arise from various other causes. Their possible causation by strain due to refractive errors should be borne in mind and such origin determined or excluded by broad systematic medical diagnosis." These words of Edward Jackson[8] state a problem that comes before us every day. It may be briefly summarized in this question:

Are the refractive errors of this patient the cause of his general disturbances? In the light of the findings here presented in the charts we must suspect deficiency of nutrient materials as the chief factor. Given more time the glasses alone in the control group may have brought greater relief from symptoms. Or the number of patients with refractive errors that produce these major symptoms may have been too few to influence the general picture on the chart. However, the picture presented adds significance to the nutritional approach. This is supported by Borsook's observation:[5]

"In adults mild vitamin-B deficiency is responsible for much of the constipation, flatulence, and dyspepsia characteristic of middle and old age. With this condition frequently go headaches, lack of stamina, and chronic fatigue. This whole complex of symptoms can in most cases be relieved (if there is no ulcer, tumor, or infection) by a good diet fortified by a daily supplement of 750/1000 international units of thiamine and a liberal amount of the remainder of the B complex."

It is of great practical importance to study both the dietary habits and these general symptoms of patients. If the diet is faulty, as from omission of milk and cheese and inclusion of excess sweets and pastries and white breads (devitalized foods), then we have an indication for the giving of vitamins with a good diet, while at the same time we have reason to expect some relief of these general disturbances that would persist if glasses alone were given. Expressed in another way, prognosis should be guarded when nothing but glasses are contemplated for the patient with many symptoms and a faulty diet. It may be advisable to correct the diet, and prescribe vitamins one or two weeks before doing the refraction, because in many cases within that short period of time the patient shows less fatigue and less nervous irritability. This procedure is also indicated for the complaining patient who has "been the

Charts 1 to 12 (Moose). The dark area indicates the percentage of patients with the symptom as a major or chief complaint. The heavier shaded area indicates the percentage of patients with the symptom as moderately severe, and the light shade indicates that the symptom was slight. Open area of circle represents the percentage of patients not disturbed by that symptom.

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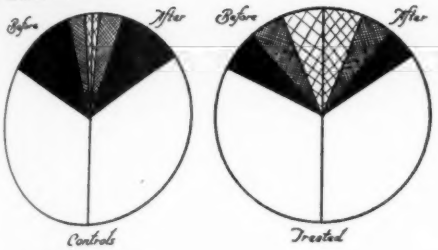
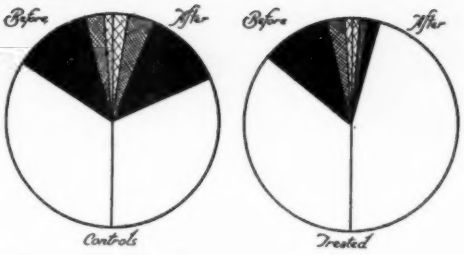
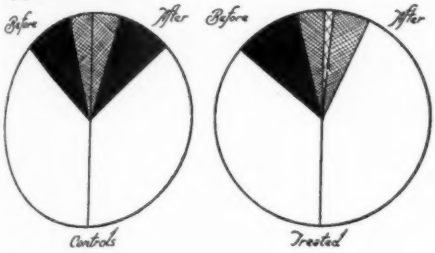


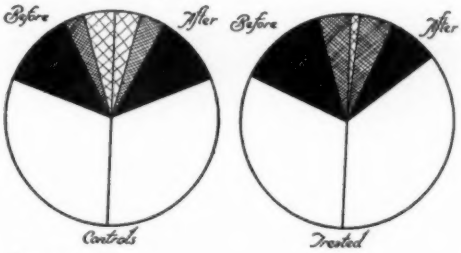
2. Chilly Sensations



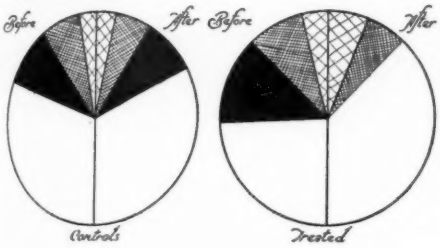
3. Skin Disturbances



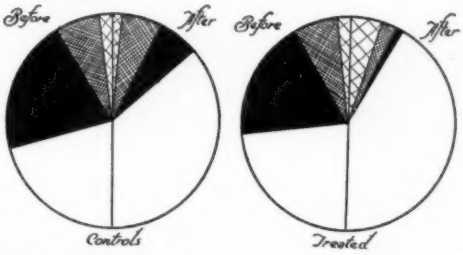
4. Cold or Moist Hands



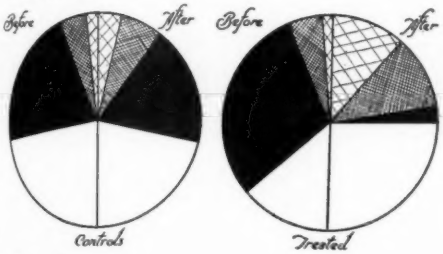
5. Rheumatic Pains



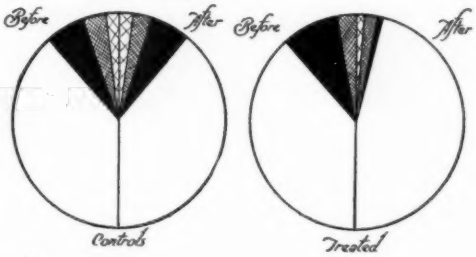
6. Headaches



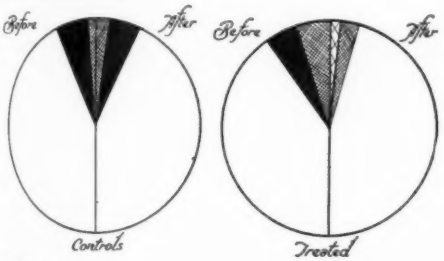
7. Fatigue



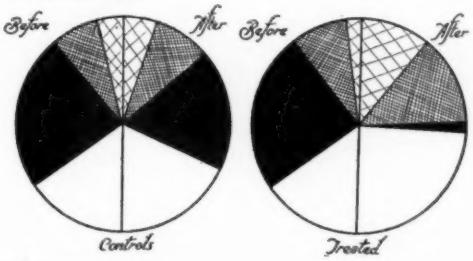
8. Digestive Complaints



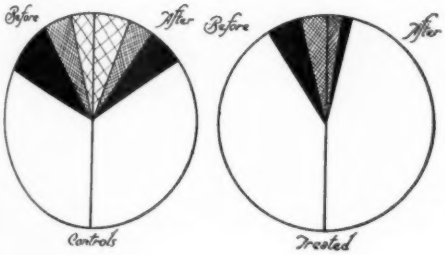
9. Poor Appetite



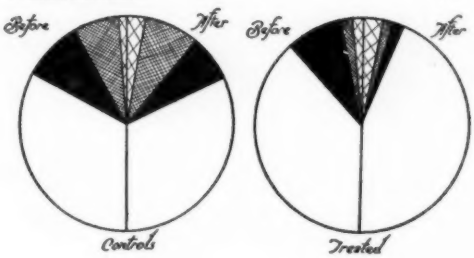
10. Nervousness



11. Dizzy



12. Sleeplessness



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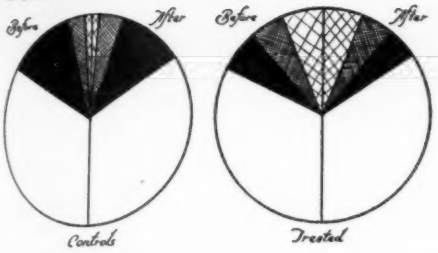
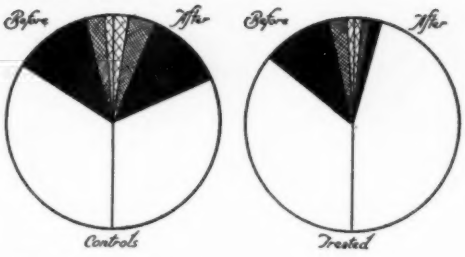


2. Chilly Sensations



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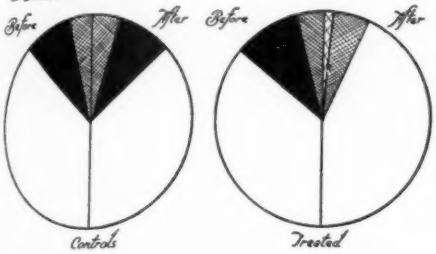

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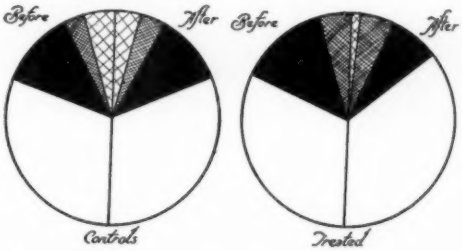

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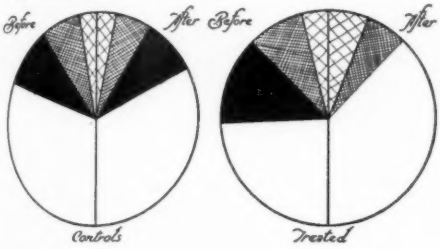

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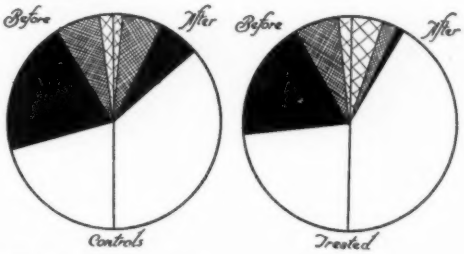
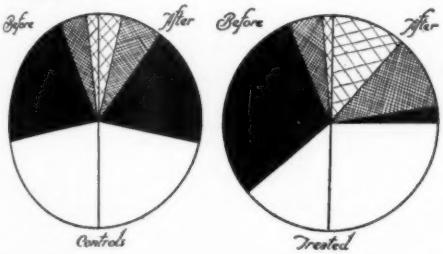


7. Fatigue



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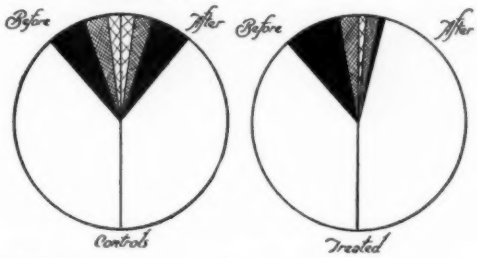

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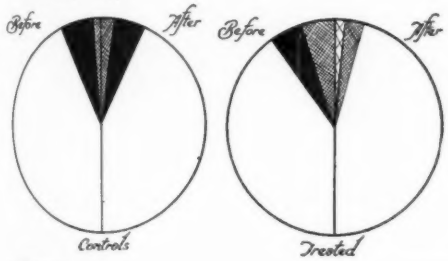

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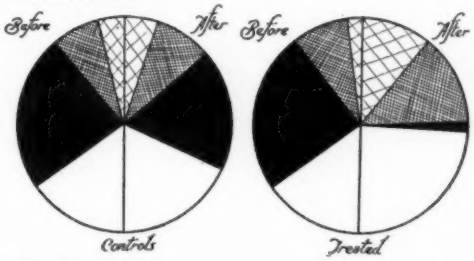

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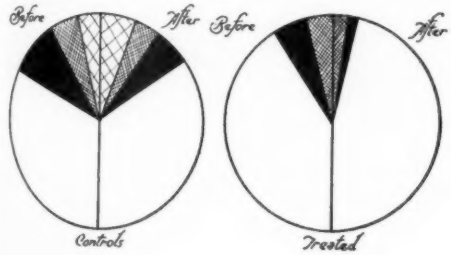

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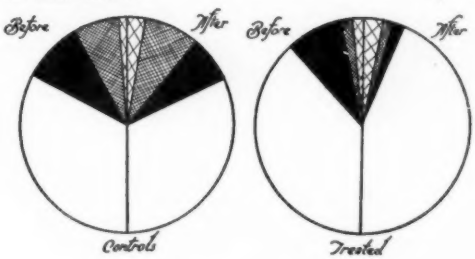

rounds." With the improved nutrition the patient simply complains less; he becomes more cheerful, and ceases to worry about trivial things; his disposition is changed.

In a study of 82 cases of vitamin-A deficiency Cordes and Harrington[9] have drawn attention to different local symptoms that persisted after . . . "the correction of the usual causes of asthenopia." After treating these patients daily with 30,000 units of vitamin A they report this observation: "It is interesting that in the majority of cases some improvement of the symptoms was noted within a week or 10 days from the time therapy was started." Also reported was relief of a few general disturbances that we are discussing. These observations add emphasis to the essential need of considering the nutritional requirements of patients.

The rapid relief of these symptoms in some cases may be analogous to the relief afforded pellagrous patients when they are taking specific treatment. There the mental and emotional outlook, the fatigue, the pain, the loss of appetite, the diarrhea, and the red tongue that is caused by the dilated capillaries, are known to disappear in a spectacular way on proper therapy.[10] Such symptoms are evidently caused by "biochemical lesions" in the fluids of the body, and cease to exist with the proper chemical changes. Yet the skin lesions of pellagra are anatomic in nature and are slower in changing. In a similar way among these cases for refraction we may suspect both biochemical and anatomic lesions. The chemical pathology with functional derangements may appear months or years before the development of anatomic pathology with the manifest organic changes. One phase of preventive medicine is to cure functional disease before it leads to organic disease. An effort in that direction is not to fail to study the food habits of those patients with negative physical findings who are ordinarily dismissed as neurasthenics.

Regarding the tremendous influence of diet even on chronic degenerative disease, I wish to quote Langstroth who wrote his conclusion on his work 11 years ago in the Journal of the American Medical Association:[11]

"By feeding a diet containing a high percentage of protective food, degenerative disease can be modified, usually in the sense of mitigaiton of distressing symptoms, often in the sense of actual restoration of the integrity of injured structure."

If an improved diet is of benefit to one organ, it must be of benefit to all other organs; hence of value in all eye therapy.

Ophthalmology makes satisfactory progress only with the study and application of the advances made in other sciences.

575 Fifth Street.

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IS ENUCLEATION INDICATED IN EARLY CASES OF INTRAOCULAR MALIGNANT MELANOMA?*

A REPORT OF TWO CASES

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Philadelphia

At the last meeting of this Section, Lieutenant Colonel Ash of the United States Army presented a most informative lecture on the subject of malignant melanoma. I should like to present at this time two such cases of unusual interest as a subsequent contribution with a possible new therapeutic approach, based upon facts obtained from the literature and upon the results obtained in a study of these two patients of the same age (49 years), observed simultaneously from the beginning of symptoms to a fatal termination.

A synopsis of these facts or near facts follows: 1. There is some inkling of evidence that the expectancy of life is greater in instances in which the offending eye is not removed early. 2. There are many data to prove that there is a tendency to spontaneous cure. Necrosis was present in 67 of 94 tumors examined by Terry and Johns as reported in the American Journal of Ophthalmology (1935, v. 18, Oct., pp. 903-912). 3. It is worthy of note that the spindle-cell subtype B is not malignant in that there is no metastasis. 4. Malignant melanoma limited to the eyeball does not cause death. Fatalities are always caused by metatasis to other organs. 5. It has been observed by many contributors to the literature that tumors grow relatively slowly and may be confined to the eye for months, even years. 6. Malignant melanoma is resistant to the X ray and to radium. 7. Early enucleation or exenteration does not prevent metastasis or death. Forty-seven percent of the patients in the series reported by Ash died within a period of five years after enucleation. 8. Inasmuch as malignant melanoma arises from neuroectodermal cells, the new approach in the control of this malignancy must be centered about destruction of the nervous elements from which the tumor grows.

I now present two cases, both occurring in males who were both 49 years old, under my observation at the early onset of symptoms until their death in 1941.

In case 1, the offending eye was removed early when the vision was still excellent, but the patient succumbed to metastasis in other parts of the body within a period of slightly less than eight years.

In case 2, the patient refused enucleation for a period of nearly 10½ years, but submitted to the ordeal after perforation of the globe, death being precipitated by a fracture of the skull in an automobile accident.

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*From the Wills Hospital. Read before the Eye Section of the College of Physicians of Philadelphia, April 17, 1941.

Case 1. J. M. was first examined on May 8, 1933, at which time visual acuity in the right eye was 5/12, in left eye 5/5. There was a history of an accident in a bathtub in which the patient sustained an injury to the right eye and temple when he fell against a towel bar. Disturbed vision occurred two weeks after injury.

Ophthalmoscopic examination revealed a partially solid, partially fluid detachment in the lower hemisphere midway between the optic disc and the ora serrata.

The patient was admitted to the Wills Hospital on May 10, 1933. Consultation with Drs. Griscom and Siggins resulted in unanimous agreement that the patient had an intraocular melanosarcoma. Enucleation was advised. The operation was performed on May 13, 1933. The laboratory report on May 16th verified the diagnosis of malignant melanosarcoma of the choroid.

After further consultation with members of the X-ray Department, radium treatment was applied over the socket and adjacent parts, of sufficient dosage and duration to satisfy the roentgenologist. The patient returned to his usual vocation as a construction engineer. Due to his employment out of town, he was not again examined by me until March, 1935, when he presented a healthy socket. Visual acuity of the other eye was 5/5.

On November 23, 1940, the patient returned to Philadelphia as an invalid by reason of various complications discovered by his physicians in attendance in Washington, D.C. A report from the roentgenologic laboratory of Dr. Joseph F. Elward of that city is summarized as follows: 1. Metastatic sarcoma of the right mid-lung. 2. Metastatic involvement of the vertebrae, especially the sixth dorsal.

Ophthalmoscopic examination made by me on November 23, 1940, revealed a choked disc of six diopters in the left eye.

The death certificate dated March 4, 1941, stated the following causes of death: 1. Sarcoma of the lung. 2. Sarcoma of the spinal vertebrae, and cerebral metastasis.

Case 2. F. E. consulted me on October 8, 1930, because of a painful, sightless left eye which had troubled him for six or seven months. A diagnosis of secondary glaucoma was made. There was doubtful light perception; the intraocular tension was 90 mm. Hg plus; the lens was opaque; the anterior chamber shallow, and the iris was well vascularized. An intraocular tumor was suspected. The patient refused enucleation.

In an effort to relieve pain a basal iridectomy was performed. Except for infrequent intervals when the patient met with minor accidents, he actually had no ocular pain during the remainder of his life.

I observed him from time to time until his death on February 17, 1941. At no time did glaucoma develop in the opposite eye. The patient experienced several accidents during alcoholic debauches in which the eye developed hyphemia. He was injured while riding in a taxicab on November 18, 1938, when he developed a hemorrhage in the eye. He again refused enucleation.

On August 9, 1940, the patient experienced disturbed vision of the right eye. Examination revealed a complete temporal hemianopsia.

He was admitted to the Wills Hospital on September 20, 1940, at which time visual acuity in the right eye was 5/21; the left eye was totally blind. Neurologic examination at that time revealed no evidence of a space-preëmpting lesion of the brain.

The patient was readmitted to the Wills Hospital on November 9, 1940, manifesting an extensive proptosis of the left eye.

At this time, the patient agreed to enucleation. The operation was performed on November 26, 1940, by my senior assistant, Dr. Edw. J. Donnelly, who removed not only the eyeball but a large tumor mass the size of the eyeball itself attached to the posterior segment.

The laboratory diagnosis was intraocular and extraocular malignant melanoma.

The patient was then referred to the Philadelphia General Hospital for deep X-ray therapy. While being conveyed there early in January, 1941, he met with an automobile accident resulting in a fracture of the base of the skull. He apparently recovered from the fractured skull and was well enough to return to the Philadelphia General Hospital, to which he was admitted and where he finally succumbed after a few days, on February 17, 1941.

Autopsy was performed by the coroner, at which the only principal pathology was found to be located in the brain. Dr. B. Alpers, professor of neurology at the Jefferson Medical College, found a tumor in the region of the chiasm. The tumor was about 2 cm. in diameter, firm and dark brown in color. It had so distorted the chiasm that this structure was twisted to the right and lay in a sagittal plane. The left optic tract swept around the posterior border of the tumor. A capsule enclosed much of the tumor and it was easily separated from the neighboring vessels in the circle of Willis. It was more intimately bound to the chiasm and the optic nerves and tracts. Efforts to separate these structures from the tumor tore the latter and revealed a somewhat necrotic mass near the surface.

Horizontal sections of the cerebrum at such a level as to uncover the third ventricle exposed a tumor nodule on the most anterior portion of the floor of this cavity. This nodule was apparently continuous with one observed externally and presented the same gross characteristics except for its dimensions. It measured 1 cm. by 1 cm. by 2 cm.

Some thickening of the vessels at the base of the brain was the only other pathologic lesion found grossly.

Gross diagnosis: Suprasellar sarcoma (history of recent removal of the left eye for sarcoma).

It would be fair to assume that had the patient not met with an automobile accident and sustained a fracture of the base of the skull, he might have lived a few months longer. He lived 11 years from the time of the original eye symptoms.

There is one outstanding fact in reviewing these two cases. The patient who refused enucleation when his eye was painful and blind lived longer than the patient who submitted to enucleation when the visual acuity was still 5/12.

It should not necessarily follow that all future cases will result in a similar comparative period of longevity, but it is strikingly convincing when one is able to compare similar malignant tumors in patients of the same age, and observed at the same time by the same physician.

The theory presents itself that early enucleation in a case of malignant melanoma that is confined to the eyeball is not a satisfactory surgical procedure in terms of life expectancy. As long as a tumor remains in the eyeball, it may not affect the patient's life. If it were possible to keep the tumor confined to the eyeball it would likewise be possible to prevent metastasis and death.

We know that radiologic treatment of the tumors not only fails to reduce but may stimulate their growth.

We have learned from Ash, Theobald, and Mason that melanosarcomas are neuroectodermal in origin, arising from the cells of the sheath of Schwann. It occurs

to me—and this is purely theory—that the new approach in the control of these tumors in the eyeball in the early stage would center about a physical destruction of the ciliary nerves from which the malignant tumors arise.

Fortified by the information that the tumors themselves attempt to undergo voluntary liquefaction, as evidenced by the high incidence of necrosis in tumors, we should be justified in deducing that necrosis may be intensified by a denervation of those nervous elements from which the tumor cells grow. Such denervation may be surgical or chemical. I am more inclined to lean toward the theory of denervation by retrobulbar injections of alcohol, which tends to destroy nerve cells by its chemical affinity for nervous tissue.

It is, therefore, probable that control of the growth of intraocular melanoma may be brought about by repeated retrobulbar injections of alcohol on the basis that alcohol destroys nervous elements and that malignant melanoma is derived from nerve cells. If alcohol as a denervating agent is injected during the early stages when the tumor is still within the limits of the eyeball, it may also render the tumor more sensitive to treatment by radium and the X ray. I present this theory of control by retrobulbar injection of alcohol in the absence of any proof or protocols to substantiate it.

Malignant melanoma is a rare disease; it would take a life time of practice for a single ophthalmologist to substantiate the theory I have outlined. It is presented at this time with the hope that sympathetic ears and a willing coöperation may be obtained from my colleagues in carrying out with me this procedure of denervation, more particularly in view of the fact that most of us are helpless in the effort to stave off the fatal outcome of this tumor. By pooling experiences the ophthalmic profession may obtain some ray of hope for the patients of the future. Neurosurgeons have accepted the efficacy of the injection of alcohol for nerve pain in tic douloureux and other nerve diseases. Dr. C. E. G. Shannon of Jefferson Medical College reported only a few months ago his success in alleviating pain in blind glaucomatous eyes by retrobulbar injections of alcohol. This is accomplished by causing degeneration of the ciliary nerves.

With this new theory of treatment the patient loses nothing. He loses no time because he is living on "borrowed time." The ophthalmologist is unable to tell clinically whether he is dealing with a malignant or a nonmalignant melanoma.

Colonel Ash has cautioned us to be rather conservative in the treatment of epibulbar melanomas on the ground that the benign type may grow unusually large before it becomes destructive. We are advised by investigators that malignant melanoma is of slow growth; therefore procrastination will do the patient no harm. The second case I have cited points to the fact that failure to enucleate early in no way curtailed the life span of the patient.

1321 Spruce Street.

NOTES, CASES, INSTRUMENTS

EXTREME PREMATURITY AND FIBROBLASTIC OVERGROWTH OF PERSISTENT VASCULAR SHEATH BEHIND EACH CRYSTALLINE LENS*

I. Preliminary report

T. L. Terry, M.D.
Boston

A six-months-old infant, one of twins born about two months prematurely, was found to have a grayish-white, opaque membrane behind each crystalline lens (frontispiece A and B). The pupillary responses were normal and the eyes transilluminated clearly. A jerky, irregular, and somewhat searching nystagmus was present. The membrane did not cover the entire posterior surface of the lens. Below at the extreme periphery, a clear fundus reflex could be obtained when the pupils were fully dilated. In this region thin dentate processes extended from the membrane peripherally as if they were attached to the ciliary processes (frontispiece, C and D). The membrane apparently was what is commonly, but perhaps erroneously, called persistent tunica vasculosa lentis. One of the consultants, Dr. Paul A. Chandler, has a case almost indentical in appearance in an infant also born very prematurely. Both of these infants were under the care of Dr. Stewart Clifford who discovered the ocular pathology. Recently, three other cases have been seen in the clinic of the Massachusetts Eye and Ear Infirmary. The findings are quite similar to those mentioned, even to the dentate periphery. All of these infants were premature, all weighed three pounds or less at birth, and no evidence of hereditary factors has been found.

It has not been determined whether this abnormal tissue is a persistence of the entire vascular structure of the fetal vitreous† or a fibroblastic overgrowth of the persistent tunica vasculosa lentis. Since the hyaloid artery does not close normally until about four to six weeks before full-term development, prematurity could be an important factor not only in preventing normal involution but also in producing an overgrowth of supporting tissue. In all probability this abnormal membrane does grow after birth since it has no exact counterpart in the normal fetal development of the eye. The sporadic persistence of tunica vasculosa lentis in full-term infants is usually limited to one eye as if the lack of involution were a purely local disturbance.

Correspondence with ophthalmologists in many medical centers and review of the literature indicate that this condition has not been encountered generally and that no really satisfactory therapy has been devised. Treatment of these infants, so far, has been along three lines. In some cases it was decided to temporize, awaiting delayed involutional processes. Another patient was given X-ray therapy to see if irradiation would close the embryonic vessels supplying the membrane or have any specific lytic effect on the differentiating mesenchyme that is presumed to make up the membrane. In another case an attempt was made to close the hyaloid artery behind the membrane by diathermy. Such bold surgery was used because a spontaneous hemorrhage in the membrane, increasing in amount, was threatening to become disastrous. Although all of

*From the Massachusetts Eye and Ear Infirmary. This investigation is made possible through the Special Fund for Research for Pathology Laboratory.

†Personal communication from Dr. Henry Haden of Houston, Texas.

these treatments seem of some benefit, insufficient time has elapsed to evaluate them. From laboratory specimens in unilateral cases, unrelated to prematurity, it is evident that bold removal of the membrane following eradication of the lens is dangerous. Removal of portions of the ciliary processes and retina with the membrane has occurred.

In view of these findings perhaps this complication should be expected in a certain percentage of premature infants. If so, some new factor has arisen in extreme prematurity to produce such a condition. Should this group of cases be not a most unusual coincidence, but a complication in extreme prematurity, then it is important not only to establish the frequency but also to work out promptly the most satisfactory therapy.

A careful study of all cases and pathologic material is being made and an intensive experimental investigation has been started. A complete report will be published later. The purpose of this preliminary report is to bring this condition to the attention of the profession. Other ophthalmologists having similar cases may become interested in the problem so that the frequency, the cause, and the full nature may be determined. Not only might extremely premature infants receive whatever prophylactic treatment proves most effective but also the discovery of an effective therapy might come soon enough to prevent the infants now being observed from developing amblyopia ex anopsia.

140 Marlborough Street.

THE CULTIVATION IN PURE CULTURE, OF THE DIPLOBACILLUS OF MORAX-AXENFELD (HAEMOPHILUS DUPLEX) —BERGEY

S. HANFORD MCKEE, M.D.
Montreal, Canada

With the introduction of chemotherapy to ophthalmic therapeutics, investigators soon began to consider the local effect of the newer drugs on the pathogenic conjunctival bacteria. This has given considerable impetus to ophthalmic bacteriology, and in reply to a number of requests as to the best method of obtaining the Morax-Axenfeld diplobacillus in pure culture, for study purposes, I am submitting the following short account for publication.

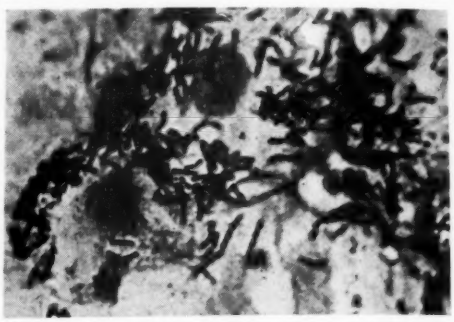

Fig. 1 (McKee). Diplobacilli in great profusion, in a direct smear from conjunctiva.

The clinical picture of Morax-Axenfeld conjunctivitis varies a great deal from mild (with slight secretion) to severe (with considerable discharge), and in these latter cases the diplobacilli will be found in great profusion (fig. 1). The bacilli lie for the most part in pairs or in short chains. They are 0.4 to 0.5 by 2 microns long, and have rounded ends, which may appear square in the chain forms. The line of separation between the pairs is very definite. The bacilli are gram

negative; the decolorization by Gram is rapid and complete. Opinions vary regarding the presence of a capsule. I have stained many direct smears for capsule, but have never been satisfied as to its presence. Morax called it capsule free, and Axenfeld said the capsule was not clearly seen.

The diplobacillus of Morax Axenfeld grows only at blood temperature, and with certainty, originally at least, only on blood serum, agar containing serum, or media which contain human-body fluid. Axenfeld says, "the diplobacillus can often be obtained in pure culture from cases with profuse secretion, provided that the lid margins and angles are not touched." This has not been my experience. I do not remember ever having obtained it in pure culture in the original growth.

Loeffler's alkaline blood serum of pH 8 is recommended as the most serviceable culture medium for routine cultivation of the Morax-Axenfeld diplobacillus, but it is unsatisfactory to use for the original culture, because this is nearly always a mixed growth. Generally there is a considerable growth of Staphylococcus, either the epidermidis albus or the aureus, which soon overgrows the diplobacilli; and to obtain diplobacillus in pure culture, from a mixed growth on blood serum, is no easy task.

Fig. 3 (McKee). A pure culture of the Morax-Axenfeld diplobacillus, after 24 to 48 hours in the incubator.

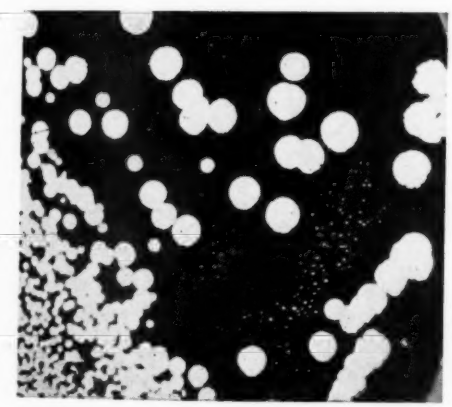

Fig. 2 (McKee). Primary culture on hemoglobine agar, showing large white colonies of Staphylococcus, between which are seen many small separate colonies of the Morax-Axenfeld diplobacillus.

Because I found this method so unsatisfactory, I began using, for the initial culture, alkaline human hemoglobin-agar plates of pH 7.4 in the following manner:

With a platinum needle, a small amount of discharge is taken from the conjunctival sac and placed on the agar plate. By means of a platinum loop, it is then "spread" over the entire plate surface and put in the incubator. After 24 to 48 hours, one will find scattered over the surface separate colonies of pyogenic cocci, generally the epidermidis albus, which on this medium has a bluish, glistening appearance. Between these colonies, one will find small raised grayish colonies in different sizes, which re-

semble the colonies of the Bacillus xerosis (fig. 2). With the greatest ease, the diplobacillus may now be obtained in pure culture, by picking off one of these small colonies and inoculating either hemoglobin-agar or blood-serum culture medium, preferably the latter.

This is a fairly simple and satisfactory way of obtaining the Morax-Axenfeld diplobacillus in pure culture, and is a method I have practiced for many years.

After 24 to 48 hours in the incubator, the surface of the blood serum will show tiny, moist-looking depressions which gradually spread, increasing in depth and width, gradually liquefying the blood serum. This appearance on blood serum is most characteristic (fig. 3). Liquefaction continues for a week or so, and even on the second day one may find the prepared slide filled with involution forms. On serum-agar medium, the colonies show themselves as flat grayish bodies; in serum bouillon, the growth produces a turbidity. The reaction of the culture medium is important. It should always be slightly alkaline, as the diplobacillus will not grow on neutral or acid media.

The culture characteristics of the Morax-Axenfeld diplobacillus differentiate it easily from the other known pathogenic conjunctival bacteria. There is, however, another diplobacillus that is very similar—Petit's diplobacillus liquefaciens—found generally in cases of ulceration of the cornea. In morphology it is strikingly similar but culturally it is very different, in that it grows readily and profusely on the ordinary culture media, and liquefies gelatin. These two characteristics differentiate it from the Morax-Axenfeld diplobacillus.

To keep a culture of the Morax-Axenfeld diplobacillus viable, it should be transferred about every third day.

1528 Crescent Street.

ALLERGIC DERMATITIS AND BLEPHAROCONJUNCTIVITIS CAUSED BY PONTOCAINE*

PAUL T. MCALPINE, M.D. AND CONRAD BERENS, M.D.
New York

Among the agents developed in recent years to produce local anesthesia in the eye, pontocaine (p-butyl-amino-benzoyl-dimethylamino-ethanol) is one of the most commonly used. Since novocaine (p-amino-benzoyl-diethyl-amino-ethanol-hydrochloride), to which it is related chemically, is a recognized cause of allergic dermatitis, it may be presumed that allergic reactions to pontocaine are not uncommon. However, according to the literature, this is not the case. Only one instance of hypersensitiveness to pontocaine has been reported in the American literature,[1] but several papers have appeared in the German literature,[2, 3, 4, 5, 6, 7, 8] one in the Egyptian,[9] one in the Swedish,[10] one in the Dutch,[11] and one in the French.[12]

Shimkin's report[12] of his own dermatitis caused by pontocaine led to the present report of four cases of chronic dermatitis of the fingers. One case was associated with ocular hypersensitivity and the three other cases revealed no ocular hypersensitivity.

Case 1. In January, 1938, after using pontocaine in the course of our work for one year, the skin of the radial side of the left thumb of one of us (P. T. M.) became dry and cracked. Shortly afterward, the skin of the tips of the second and third fingers became similarly involved. These were the fingers with which the cotton was held when drops were instilled in the patient's eyes and on which the solution often overflowed. Patch tests were done with the different drugs habitually used (atropine, cocaine, fluorescein, and

* Aided by a grant from the Ophthalmological Foundation, Inc.

pontocaine). However, only pontocaine produced a reaction, which consisted of an erythematous area of the skin, associated with pruritus which persisted for several days. Pontocaine instilled in the eye caused no undue reaction. An attempt was then made to avoid contact with the pontocaine. When there was no contact with pontocaine, the dermatitis subsided, but there was a flare-up in the skin reaction whenever the pontocaine touched the fingers. Thereafter, the right hand was used to hold the cotton and the left hand, the dropper. Several months later, the tip of the finger of the right hand became involved.

Case 2. A similar sensitivity resulting in a dermatitis occurred in another colleague, an ophthalmologist (Dr. A. C.). However, his skin reaction remained limited to the tip of one finger, and there was no ocular hypersensitivity. Patch tests were positive only for pontocaine.

Case 3. A third colleague (Dr. H. E.) was affected in the same way and in addition presented a conjunctival hypersensitivity when there was conjunctival contact with pontocaine. Patch tests were strongly positive for pontocaine. By using holocaine he avoided further skin reaction.

Case 4. Another colleague (Dr. J. J.) was affected by a dermatitis of the fingers which developed after using pontocaine for one year. Patch tests were strongly positive for pontocaine. Instillation of the drug in the conjunctival cul-de-sac caused no reaction.

Conjunctival hypersensitivity with associated reaction of the skin of the eyelids, when a 0.5-percent solution of pontocaine was instilled in the conjunctival cul-de-sac, was also present in three patients of one of us (C. B.). Patch tests were positive in two patients but not in the third patient.

Apparently pontocaine can also damage the cornea, for three cases are described by Klar.[13]

Conclusions

Although pontocaine has caused allergic blepharoconjunctivitis in three of our patients and occupational dermatitis in four ophthalmologists, the great majority of persons are not allergic to this drug. In spite of the small number of published reports, there may be many oculists and other physicians as well as patients to whom pontocaine is a source of severe discomfort.

However, pontocaine has certain advantages over other local anesthetics used by ophthalmologists, and we believe its routine use is not contraindicated unless hypersensitiveness develops.

35 East Seventieth Street.

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THE INFLUENCE OF GRAVITY ON INTRAOCULAR FOREIGN BODIES

R. J. Curdy, M.D.
Kansas City, Missouri

In the textbooks and in the periodical literature the need of extremely accurate localization of intraocular foreign bodies is emphasized. This is especially necessary when the foreign body is small, since then the prognosis is good for the preservation of useful vision because of the minimum of trauma at the time of injury and also at the time of operation. It seems to be assumed that the foreign body, even if in the vitreous, will remain in the position shown by the X-ray studies, though surely change of position must often be observed.

Beard ("Ophthalmic surgery," ed. 2, p. 716) recognizes the probability of change of position, and says "The direction of the eye should be the same at the time of the exposure to the rays as at the time of surgical intervention. Omit this precaution and the whole procedure of localization comes to naught"; and Würdemann ("Injuries of the eye," ed. 2, p. 235) says "A foreign body in the vitreous can change position on the patient assuming the upright position."

But I have been unable to find any suggestion that gravity can be utilized intentionally as an aid during operation. When a foreign body is free in the vitreous it can make considerable change of position under influence of gravity, immediately or hours later, and the change can be controlled by regulating the position of the patient. Even if the foreign body is embedded and fixed, prolonged action of gravity can bring about a change in its position. Three recent cases are in point.

Case 1. A thin chip of steel of pinhead size entered the eye at the limbus. At the time of examination the small wound of entrance had healed but was visible, and behind it a small hole in the periphery of the iris. Otherwise the eye appeared perfectly normal, the media perfectly clear; no fundus lesion nor foreign body was visible with the ophthalmoscope even with the eye rotated strongly in all directions. However, with the patient flat on his back the foreign body, free in the vitreous, came plainly into view.

Case 2. A small chip of steel was localized in the vitreous. With the patient on the operating table repeated attempts with the magnet failed. He was placed prone, the head projecting face down beyond the end of the table. Then the magnet, applied from below, secured the foreign body at the first trial. The magnet tip was placed only in the lips of the scleral incision.

Introduction of magnet tips or other instruments into the vitreous is poorly tolerated, and of itself constitutes traumatism that is destructive, all the more so when added to the effects of the original injury. The foreign body should first be brought within reach of the small magnet with its tip no deeper than the limits of the scleral incision, otherwise there is the ever-present impulse or necessity to invade the vitreous with harmful effect. The giant magnet may be used to bring the foreign body to the desired position, but has the fault of uncontrolled force which increases greatly as the body approaches the magnet. Impinging on

retina and choroid results in bruising and laceration, and often unmanageable entangling. Gravity brings the foreign body to the accessible position with the least possible disturbance; its action is constant, uniform, and gentle.

Nonmagnetizable foreign bodies are much more difficult to manage because they cannot be removed by any means excepting forceps or gravity, but gravity alone is often sufficient.

Case 3. The eye of a nine-year-old boy was struck by a no. 5 birdshot which entered the eye at the temporal limbus, lacerating the iris and lens, and lodging in the vitreous, as shown by X-ray localization. The globe was soft and filled with blood. The boy was kept in bed, in the prone position, and after two days the shot appeared under the conjunctiva of the nasal side of the globe. Incision of the conjunctiva for removal of the shot revealed a linear vertical rupture of the sclera on this (nasal) side through which the shot had been extruded. Subsequent X-ray examination showed absence of the foreign body previously localized in the vitreous. It is probable that the shot entered the eye at the temporal side crossing via iris and lens to the nasal side where it made a scleral rupture but rebounded into the vitreous. The eye recovered with good form and appearance but with only light perception.

There are many instances of spontaneous extrusion of intraocular foreign bodies, some after being in the eye several years. The extrusion is usually (always?) through the lower portion of the sclera, which means that gravity is the determining influence. This suggests that such influence may be used to bring the foreign body from an inaccessible position to one accessible to operation, and also that it may be an aid to the action of magnet or forceps at the time of the extraction. With the patient nearly prone, several days if necessary, to bring the foreign body into the lower temporal vitreous and then X-ray test to demonstrate its position, slight retraction of a scleral incision made at the dependent point would admit delivery of the foreign body by gravity alone. Most amenable to this procedure are the foreign bodies that are smooth and heavy, such as birdshot, but even jagged or entangled bodies may then be reached with forceps without entering the vitreous.

F. E. Woodruff (Amer. Jour. Ophth., 1939, May, p. 548) reported the case of an eye in which a birdshot was retained for 18 years, and had gravitated to the lower vitreous. It was removed through an incision in the sclera. "One lip of the wound was depressed and the shot fell into the spoon." The posture of the patient is not stated, but gravity must have been in effect. Discussing this case Mason thought we have "been neglectful in not giving a little more study to the removal of nonmagnetic foreign bodies." This thought is the more impressive when we are dealing with a patient whose injured eye is his only eye. In such a case Cross (Trans. Amer. Ophth. Soc., 1927, p. 80) devised a most ingenious method for removing a birdshot from the vitreous of an only eye under direct X-ray visualization, using a special forceps made for this case. In such cases the preservation of even a little vision is a real achievement.

In all cases of intraocular foreign body, magnetic or nonmagnetic, if gravity suffices to change the position of the foreign body this can reduce greatly the operative manipulation necessary for removal and make material difference in final results. A special extension of the operating table consisting of a bracket of rods fixed to carry a hammock of fabric to support the patient's head would reduce the awkwardness of operating from below, but even without special arrangements operating from below is not too difficult.

1409 Bryant Building.

KNIFE INJURY

A CASE REPORT

MAXWELL THOMAS, M.D.
Dallas, Texas

Routine practice of ophthalmology is frequently made more interesting and at times even dramatic by unusual cases. Many such cases are instructive while others are definite curiosities, and it is for the last-named reason that an unusual injury to the orbit is presented with pictures.

A white boy, age 16 years, was stabbed in the left orbit with a knife blade, over three inches long, which remained in place as pictured (fig. 1) for over two hours. It was so firmly embedded that under a general anesthetic strong force applied with several pairs of pliers had to be used to remove it.

The recovery was uneventful with no discomfort other than the rise of temperature the first day to 102°F. No real drainage nor evidence of infection was present. After five days the patient was dismissed from the hospital; two weeks later he had had no further trouble.

Examination. The knife entered the plica semilunaris of the left eye without even scratching the lid margin. There was no apparent injury to the eye nor to the lacrimal sac, and the movements of the eye were in no way impaired. The knife could be seen traversing both sides of the nasal cavity through the nares.

Figure 2 shows the antero-posterior position with the knife in place. The roentgenological report was as follows: "Anterior-posterior film demonstrates the blade of a long jack knife projecting into the medial wall of the left orbit, downward through the nasal cavity, through the septum, and finally resting in the wall of the right maxillary sinus. There is no evidence of penetration into the cranial cavity."

I am indebted to Dr. H. G. Montgomery, resident on surgery, City Hospital of Dallas, for obtaining the photographs, so that this report could be so vividly presented.

Medical Arts Building.

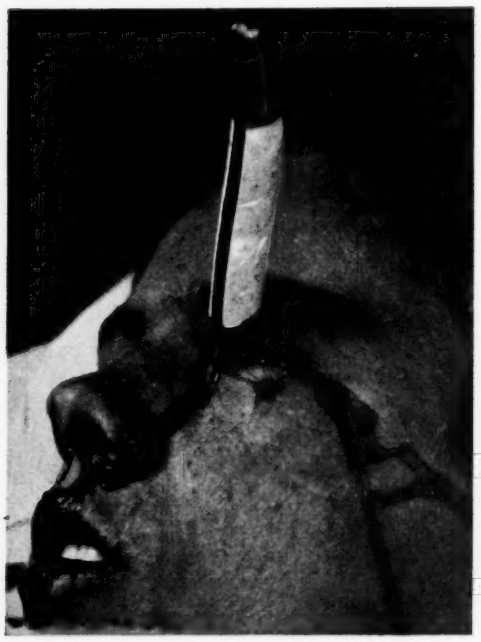

Fig. 1 (Thomas). Knife in place.

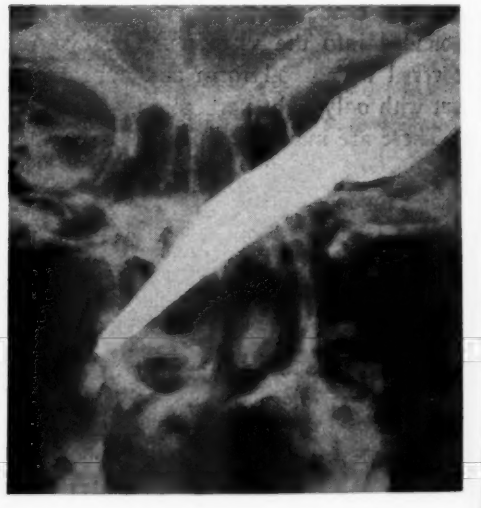

Fig. 2 (Thomas). X-ray representation of knife in place.

SOCIETY PROCEEDINGS

EDITED BY DR. RALPH H. MILLER

CHICAGO OPHTHALMOLOGICAL SOCIETY

November 18, 1940

DR. RICHARD C. GAMBLE, *president*

CLINICAL MEETING

(Presented by the Eye Department, Children's Memorial Hospital)

DR. ROY O. RISER presented a case of parathyroid-deficiency cataracts in a boy with renal rickets. (This case will shortly be submitted as a complete case history.)

DR. ROY O. RISER presented cases of retinitis pigmentosa in a boy aged 9 years, and his brother, aged 13 years, who showed mild atrophy of the retina but no pigment clumping (early retinitis pigmentosa, sine pigmento). These patients will be observed further before complete reports are submitted.

DR. HIRAM J. SMITH presented a 60-year-old man, who was first seen on August 11, 1940, following an automobile accident two weeks previously. There was an incised wound over the right brow extending to the nasal border of the left orbit. No injury to the left eyeball was observed, but the pupil was widely dilated and did not respond to light. The intraocular tension was increased, the media cloudy. Operation was refused.

On September 25, 1940, he returned to the hospital. The tension L.E. was 55 mm. Hg; R.E. 25 mm. Hg (Schiötz). The pupil of the left eye was still widely dilated. There was no response to light nor to miotics.

At operation the following day, sclerectomy, cyclodialysis, and iridectomy at the root of the iris were performed. At the time of the report the tension of the left eye was 18 mm. Hg (Schiötz). Vision was 15/200, correctable to 0.3. The media were fairly clear. No glaucomatous cupping was noted. The fields showed no contraction. The case was presented because of the occurrence of glaucoma following trauma, associated with parasympathetic paralysis of the pupil.

SCIENTIFIC MEETING

The following motion-picture films were shown: Special points in intracapsular cataract extraction by Dr. Daniel B. Kirby, New York; Intracapsular cataract extraction (Verhoeff technique) by Dr. H. Gifford, Jr., and Dr. William H. Stokes, Omaha; Transplantation of the lacrimal sac by Dr. William H. Stokes and Dr. H. Gifford, Jr.; Intracapsular cataract extraction with a new corneoscleral suture by Dr. John M. McLean, Baltimore; The use of ear cartilage as a transplant by Dr. Edmund B. Spaeth, Philadelphia; and The making of animated movies of the technique in eye-muscle surgery by Dr. A. D. Ruedemann, Cleveland.

Robert Von der Heydt.

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

November 25, 1940

DR. JOHN LORDAN, *president*

(Meeting presented by the staff of the White Memorial Hospital, College of Medical Evangelists)

GUNSHOT WOUND OF THE EYE

DR. SIDNEY BROWNSBERGER presented two interesting cases. The first patient

had received a shotgun blast at close range. The X ray localized two metallic foreign bodies in the vitreous near the posterior pole of the eye. As vision was destroyed no attempt at removal was made. When seen about one year later a foreign body was visible in the anterior chamber, lying on the iris at about the 6-o'clock position. Upon X-ray examination it was found that one piece had remained in the vitreous chamber, but that the piece now visible in the anterior chamber had migrated from its former position near the posterior pole. This foreign body was removed surgically. At the last examination a complete retinal detachment and retinitis proliferans were present.

Dr. Sidney Brownsberger presented a second case in which a bullet entered the left temple and emerged at about the bridge of the nose, severing in its course the levator palpebrae superioris muscle. The resulting ptosis was repaired with excellent results by attaching the tendon of the levator to the superior-rectus muscle. The approach was through the skin of the upper lid, and the superior rectus was exposed, leaving the conjunctival sac intact.

The remainder of the meeting was devoted to otolaryngology.

Orwyn H. Ellis,
Recorder.

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

December 23, 1940

William A. Boyce, M.D., *presiding*

(Papers and case reports from the Eye Service of the Los Angeles County General Hospital)

Pathology reports

Dr. M. N. Beigelman discussed the pathology of chalazia, illustrating the findings by colored photomicrographs which clearly demonstrated the lesions.

A gross specimen of an eye removed for malignant melanoma of the choroid distinctly showed the changes seen in stage three of the tumor. The tumor had extended into the vitreous chamber and had also perforated the sclera. The extraocular extention was in the region of the optic nerve and the posterior ciliary arteries. Dr. Beigelman gave two reasons for perforation at this place: (a) the sclera is very thin in this region, and (b) the arteries enter almost perpendicularly to the globe and hence the channels are shortest in this area.

A second specimen was presented. This was the eye of a female infant, four-and-a-half months old, who had had a persistent fibrovascular sheath in each eye. The thick membrane was seen to contain many blood vessels and was situated just posterior to the lens. A through-and-through discission had been made, and the membrane opened wide. Unfortunately this was followed by a septic endophthalmitis. The specimen showed a membrane passing from the posterior pole of the eye to the posterior pole of the lens. The question of pseudotumor was raised and Dr. Beigelman replied that the patient had been under observation for approximately two months, and that no gross changes had taken place. The final pathologic report was not yet available, but in the preliminary examination no malignant changes were found.

Congenital lenticulo-fibroblastic membranes

Dr. Warren A. Wilson discussed congenital membranes, and presented the clinical aspects of the last case demonstrated by Dr. Beigelman. Retinoblastoma and pseudotumor were considered, but when the child was examined under the slitlamp and corneal microscope the final

diagnosis was made. The blood vessels present were seen to originate in a persistent hyaloid artery. In the literature most of these cases proved to be unilateral and the membrane had been found to be attached to the ciliary processes.

Discussion. The case was discussed by Dr. William Boyce who had a unilateral case at the time, in which the differential diagnosis btween retinoblastoma and congenital lenticulo-fibroblastic membrane was not yet certain.

Carotid–cavernous-sinus aneurysm

Dr. David McCoy presented a discussion of carotid–cavernous-sinus aneurysm and case reports from the service at the Los Angeles County General Hospital. The patient usually gave a history of injury followed by bruit and brawny edema with a proptosed, pulsating eye. The orbital and retinal veins were widely dilated. Secondary glaucoma was a frequent complication, and 20 percent of the patients with this involvement lost their vision. In Dr. McCoy's series of cases there was a mortality rate of 10 percent. When the oxygen content of the blood of both jugular veins was examined, a higher oxygen content was found in the blood from the vein on the side of the lesion.

With rest and calcium as conservative treatment there was in 5 percent of the cases spontaneous cure. Cerebral anemia was found to complicate the surgical treatment. Ligation of the common carotid artery, internal jugular, and the supraorbital veins was the operative procedure of choice.

Discussion. The paper was discussed by Dr. Clifford Walker who advised thorium dioxide with X ray as an aid in diagnosis.

Ocular pemphigus

Dr. Lewis George presented a patient with severe ocular pemphigus. The case was that of a 67-year-old white male who had intense burning and itching of both eyes at the onset two years previously. The original symptoms were those of a chronic conjunctivitis. Later a watery discharge was noted and bullae were found. Following the rupture of the bullae, symblepharon formation, corneal ulcers, entropion, and finally almost complete blindness due to extensive corneal involvement occurred. The symblepharon finally became total. The condition was still slowly progressive.

Ocular pemphigus is usually divided into two classifications. The first is quite rare. This is the acute, fulminating type in which the patient usually dies within a few days after the onset. Dr. George's patient was an example of the second or chronic type. A perivascular round-cell infiltration is the first pathologic change found. Following this newly formed connective tissue invades the area. The tissue maceration leads to the symblepharon, and the destruction of the glands causes the eye to become dry. Many factors have been advanced as to the etiology and many therapeutic measures have been tried without beneficial result.

Orwyn H. Ellis,
Recorder.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

November 12, 1940

Dr. William D. Rowland, *presiding*

The visual mechanism in so-called amblyopia ex anopsia

Dr. Elek Ludvigh gave a talk on the above subject. Dr. Ludvigh had made a study of a group of 23 cases which, interestingly, determined that nine of that number, or group A, showed a diminution in vision but a perfectly normal light-differential sensitivity as compared

with the sound eye. In group B, or 14 of the cases, not only was the visual acuity diminished but the light-differential sensitivity was on the average of 7.7 times as great as that in the sound eye. He inferred that the first to be lost in the squinting eye was the visual acuity and then the light-differential sensitivity. The latter was lost rapidly, probably within a period of two years. If light-differential sensitivity had been affected the prospect of improving that eye by occluding the good or sound eye was poor.

The paper added much knowledge concerning amplyopia ex anopsia and brought out another means of experimentation.

Dr. Ludvigh plans to publish his paper at a later date.

Some aspects of the blood supply of the optic nerve and chiasm

Dr. Derrick Vail read an interesting paper on the above subject. He said that the finer details of the blood supply of the optic-nerve head and chiasm are not adequately covered in the textbooks of ophthalmology. There exists a surprising paucity of articles in the literature as well. His paper concerned itself with a review of the available literature, a theoretic discussion of the clinical aspects, and a plea for laboratory studies by those equipped to do it. Much of the material presented was copied directly from its source, chiefly the articles and writings of Wolff of England. Dr. Vail said the source of the blood supply of the chiasm and optic nerve is well known, but, what is not recognized, is the enormous variation that can occur in the distribution of the larger arteries. The blood supply of the optic nerve itself is derived from branches of the ophthalmic artery. Where the ophthalmic artery pierces the arachnoid sheath of the optic nerve, 10 mm. to 15 mm. behind the eyeball, it sends out a collateral branch that divides into two larger portions, one running anteriorly and the other posteriorly in the nerve axis. The collateral arteries are separate branches of the ophthalmic and are not derived from the central retinal artery. The latter proceeds forward without branching until it reaches the disc. The periphery of the optic nerve in the intraorbital portion is supplied by small twigs of separate branches of the ophthalmic artery. These run along the nerve surface and send innumerable small branches through the septa of the nerve into the pulp. The intracranial and intracanalicular portions of the optic nerve are supplied by tributaries of the anterior communicating branch of the circle of Willis. Here again finer capillaries penetrate the optic nerve in the meshwork of the various septa, and in this region small vessels supply a larger number of nerve fibers. This would account for the ease with which the central papillomacular bundle can be involved; that is, retrobulbar neuritis, from any cause including multiple sclerosis.

Dr. Vail said that from a study of the literature, therefore, certain clinical deductions can be drawn which indicate that it is the intracranial portion of the optic nerve that is the seat of the involvement in retrobular optic neuritis rather than the intraorbital portion.

Discussion. A point brought up by a member of the society was: Would the central artery of the retina become an end artery after it pierced the dura, arachnoid, and pia and lodged itself in the center of the nerve? Dr. Vail said that after it had reached this position it gave no tributaries but ran anteriorly to form the central retinal artery. In short, at this point it did not contribute to the nourishment of the anterior portion of the optic nerve. Dr. Igersheimer, however, presented a slide demonstrating an anomalous exception to this finding. The section showed a tributary arising from

the retinal artery after it had pierced the nerve trunk.

Demonstration of microfilaria

Moving pictures were shown of the larvae and eggs extruding from the female worm and also the worm present in the active and mobile digestive tract of the fly which acted as the intermediate post. It was an excellent movie and Dr. Quevedo, who loaned the film to be shown to the Society, was thanked by its members.

Virgil G. Casten,
Recorder.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

November 4, 1940

Dr. Morris Davidson, *presiding*

Prophylaxis and hygiene of ocular injuries

Dr. Milton L. Berliner read a paper on this subject during the instructional hour. He also presented a motion picture, "The eyes have it," through the courtesy of the National Society for the Prevention of Blindness.

Appraisal of visual defects in industry

Dr. Hedwig S. Kuhn reported a survey on the visual performance of 16,332 employees in a wide variety of industrial occupations. This included the visual acuity with and without correction, stereoscopic rating, color vision, and phoria readings for distance and near. It was demonstrated that refractive errors were negligible among adults with marked heterophorias. When taken with the stereoscope, phoria findings were found to be of more than practical accuracy. Among those doing fine inspection work it was found that individuals with poor vision worked faster because they did not see defects, while accuracy of work was in direct proportion to visual perfection.

Dr. Kuhn stressed the importance of the binocular test of visual performance and also pointed out that industry needed much more visual information about its employees than it was receiving. She said there was a need for industrial eye specialists among ophthalmologists.

The relation of ophthalmology to industry

Dr. George H. Cross pointed out that the increased demands on industry made by national defense and the production of war materials made the problem of workers' eye protection increasingly important. Industrial statistics in England showed that eye hazards were more serious than any other group of accident hazards not resulting in death. Proper visual examination and correction meant a smaller labor turnover and greater saving in time and spoiled material. Special examinations were necessary for selected occupations requiring exceptional vision. Periodic examinations and the weeding out of malingering was necessary to prevent excessive claims for damages.

He said the coöperation of officials was important in the prevention of accidents. Rest periods, air conditioning, scientific lighting, and the modern use of paint in coloring parts of machines to reduce glare and eyestrain are essential. Accurate records, trained nurses, and first-aid assistants save eyes and conserve vision for the benefit of industry as well as the employee.

Discussion on the two preceding papers was combined.

Dr. G. H. Gehrmann, Medical Director of the du Pont Works, stated that the industrial eye problem consisted of (1) the selection of eyes to fit a job, and (2)

the treatment of eye injuries in the best manner possible. Obviously in the chemical and explosives industry men must be picked who fit the job physically and whose eyes will not be a hazard to themselves and their companions.

The problem of employer protection makes an accurate estimate of vision, at the time a man is hired, important. He said that the telebinocular has been found adequate for this. Those individuals needing refraction were referred to an ophthalmologist and then returned for another check-up. All eye injuries were referred to an ophthalmologist for treatment and also for subsequent refraction when necessary.

Dr. Morris Davidson reported the result of a study of eye injuries presenting themselves at the New York Compensation Bureau. He agreed with Dr. Kuhn as to the importance of stereopsis in industry and the relation of its absence to eye injuries. He felt that an examination for stereopsis was an important part of the eye examination of every worker. Its loss by a worker was, in his opinion, more serious than the reduction of vision in one eye to 20/100. He disagreed with Dr. Kuhn as to the place of lay technicians in such examinations and felt that all the work should be done by ophthalmologists.

Dr. Leonard Greenberg, Director of Industrial Hygiene of the New York State Department of Labor, predicted that ophthalmology would become a much more important part of public-health work than it had been heretofore. Relatively, the cost in New York State per eye case was much greater than in any other type of injury. All types of disabilities averaged $644 per case, while eye disabilities cost $1,800 per case, and this did not include, of course, the cost to the worker. He said direct compensation costs were not the sole problem; and that eye conservation was a problem worthy of greater attention from ophthalmologists.

Dr. Percy Fridenberg read extracts from letters and newspapers showing how little the layman appreciated the fact that vision and eye injuries were a matter for the physician. He also called attention to a recent book which told how to improve sight by "natural methods." He said the acuteness of the problem was so great that Columbia University initiated a course in industrial medicine including the eye. He added that this was a question of medical public health and not one for the optometrist.

Dr. Joseph Pascal reëmphasized the binocular nature of normal seeing as shown by Dr. Kuhn in her tests. He suggested the inclusion of her tests in everyday refraction work. With reference to the heterophoria findings of Dr. Kuhn, he said it was true that there were many cases of heterophoria, without an appreciable refractive error, which might cause visual disturbances. He wondered if Dr. Kuhn in her investigations had taken note of the fact that phoria cases often showed marked variations when tested by different methods and also when tested at different times. Since orthophoria was an ideal condition, he asked Dr. Kuhn to define the limits of horizontal imbalance which she accepted as being within the physiological variations from the normal.

Dr. Hedwig S. Kuhn stated that those employees who had heterophorias greater than the following were considered industrially handicapped: 3 D. to 5 D. of exophoria for distance; and 2 D. to 8 D. of exophoria for near. This was on the basis of defects *as found* and not the basis of a corrective program, which she believed decidedly a question of specific jobs and efficiency.

Dr. George H. Cross agreed with Dr. Davidson that there should not be too many lay workers carrying on a medical

investigation. A company should be shown that such investigations mean money savings in increased production, less spoilage, and better work. He said that in Pennsylvania as in New York the cost of eye injuries was greater than that of any other type of industrial accident.

INTRAOCULAR FOREIGN BODIES

DR. FRANCIS D. GULLIVER presented a series of 2,400 intraocular foreign bodies all but four of which were extracted by the anterior route. He felt that his results were so good that there was little reason for using the posterior route in most of these cases. He stressed the value of the localizing X ray.

Discussion. Dr. Elbert S. Sherman presented 120 cases of intraocular foreign bodies of which only 92 percent were of magnetizable steel. He found that if there was to be a delay in obtaining an X ray it was better to go in promptly without it. In 25 percent of the cases he was able to see the foreign body with the ophthalmoscope. Of course, he said a good X ray was to be greatly desired where obtainable. He was convinced that the posterior route was preferable in many cases, and the only one in cases of nonmagnetic foreign bodies. In cases of large foreign bodies in the vitreous he exposed the posterior sclera as near to the foreign body as possible, placing two fine sutures 1 to 2 mm. apart to be used as retractors. He made a meridional incision of the sclera only and removed the foreign body with the hand magnet. In his series of cases, 17 were in the anterior chamber, 82 were in the vitreous or retina; and 44 were removed anteriorly while 27 were taken out diasclerally. By the anterior route in the 44 cases, 52 percent had 20/200 vision.

His experience did not bear out the premise that detachment of the retina frequently resulted following diascleral removal of foreign bodies. Sympathetic ophthalmia had not occurred. He did not agree that the tip of the magnet should be inserted into the wound. This was not necessary in his cases.

Dr. George H. Cross said that there were 87 different kinds of nonmagnetic alloys as compared with only 11 kinds of a few years ago. This made the posterior route important in many cases. In his opinion there was no set rule, but the type of operation should be adapted to the particular case. He said the question of toleration of foreign bodies was an interesting one but most men agreed that it was dangerous to leave a foreign body in the eye.

Dr. Francis Gulliver said he felt that unless the sclera was incised within 6 mm. of the foreign body it was impossible to remove it. From his own experience he could not see the advisability of going through the globe posteriorly when the particle could be removed anteriorly in most cases.

Sidney A. Fox,
Secretary.

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WAR OPHTHALMOLOGY

The experience of the last war and the reports from the combatants in the present war, especially British, indicate that the practice of war ophthalmology differs in but few particulars from that of civilian and industrial life. These particulars, however, are of the utmost importance and ophthalmic officers should know them or, if not, at least have the opportunity of learning them.

For instance, the ferrous content of shell and bomb cases used in this war is low. This means that the foreign bodies, especially the small ones, are essentially nonmagnetic. The successful removal of such a foreign body from within the eye requires the utmost ophthalmic surgical skill preceded by the most accurate localization by X ray that is possible. For this reason the ophthalmologist stationed at a base hospital should be thoroughly trained and equipped to handle these cases.

It is obvious that early repair of lacerations of the eyeball and adnexa may prevent loss of the eye and less plastic repair later. Indeed, the strides made in plastic surgery during and since the last war have been enormous, yet there are relatively few ophthalmic surgeons who have had the opportunity in civil practice

to gain much experience. Here, too, is an opportunity for special training.

The treatment of chemical and gas burns is but poorly understood by the average ophthalmologist. Few such cases are encountered in daily practice, although an occasional war veteran whose eyes had been burned with mustard gas has shown corneal degeneration beginning years after the injury.

The subject of ocular injuries in the war was discussed at the annual congress of the British Ophthalmological Society in 1940. Many points of great value and interest were mentioned. O. M. Duthie said that "ruptures had proved the most frequent of all serious injuries. Even when the injury was not severe the end results were deplorable. Many cases of rupture, especially those due to flying glass, were virtually untreatable. Subconjunctival ruptures, with or without dislocation of the lens, were not infrequent." E. B. Alabaster found 21 of 100 cases of eye injury after air raids showed penetrating wounds caused by metal or glass. This brings up the excellent suggestion by Sir Richard Cruise, who said that at least 50 percent of eye injuries could be prevented by some form of practical eye protection. He has introduced a visor that has been devised for the protection of the eyes not only of soldiers but of civilians, especially air-raid wardens and fire watchers. The "brass hats" have been slow to adopt this device because they argued that "visibility was seriously impeded." Sir Richard Cruise countered by saying "even if this were so, the visor need not be lowered on any occasion when it is likely to handicap the wearer."

The question of supplying soldiers and exposed civilians with nonshatterable lenses instead of their ordinary glasses is one that apparently has not yet been considered by our own authorities.

Aviation ophthalmology has been developed to a high degree in the last few years. It constitutes a specialty of its own. Few civilian ophthalmologists have been interested in getting the special knowledge required, consequently unless other arrangements are made they will have to get this knowledge the "hard way," as medical officers.

Dr. Harvey Cushing found an ophthalmologist indispensable in his neurosurgical war work, and expressed the opinion that a neurosurgical team must have available the services of an ophthalmic consultant. If the ophthalmologist has a knowledge of neurology, so much the better. Yet there are few ophthalmologists with this special training today. One of the outstanding neuro-ophthalmologists of this country, a naval reserve officer, is or has been spending his time doing routine ophthalmic work, mostly refractions. On the other hand it would be easy to guess that officers doing eye, ear, nose, and throat work will be called upon to venture an ophthalmo-neurologic opinion without his having the least knowledge of the subject.

The matter of the rehabilitation of the ocular-injured combatant is also germane to the discussion. Plastic surgery and the fitting of prostheses requires special knowledge and training. The fitting and knowledge of the uses of ocular devices to improve subnormal vision, such as telescopic lenses, loupes, and the like, necessitate training and skill.

All these problems and many more facing the ophthalmologist in military work will require solution. The suggestion is made, therefore, that the Government at once institute a course of from two to three weeks to which all ophthalmic medical officers can be sent before being called into active service. If the Government will not do this, the task should be undertaken by one of the national ophthalmic

societies, preferably the Academy. The time is short, and the effort may be costly, but in the end the results in the saving not only of vision but of the costs of blindness will justify it.

It is the duty of those ophthalmologists not called into active service to devote time and thought to research that may improve the prevention and treatment of ocular war injuries. By the ophthalmic institutions equipped for it, experimental laboratory work should be done on the problems of chemical and gas burns, protective devices, new surgical techniques, and therapy relating to war injuries. The facts and knowledge obtained should be made instantly available to medical officers by pamphlets, booklets, and journals.

Derrick Vail.

ASTIGMATIC ACCOMMODATION: BIASTIGMATISM

Among the controversies surrounding the ocular function of accommodation is that which deals with the efforts of the astigmatic eye to make the best of a more or less difficult situation.

Javal believed that astigmatism was as a rule entirely corneal. Upon this belief was largely based the widespread reliance upon the ophthalmometer for the testing of astigmatism.

In the course of time two facts became generally manifest: first, that the exact subjective astigmatism of the eye quite commonly differed in amount from that found with the ophthalmometer; second, that the measurement of corneal astigmatism itself with the ophthalmometer could not be relied upon as indicating the precise amount of corneal astigmatism which affected the visual acuity of the eye.

The principal factor interfering with the complete dependability of ophthalmometric measurement is the very frequent existence of astigmatism produced by the crystalline lens. The plus or minus axis of lenticular astigmatism lies sometimes at right angles with the corresponding axis of the corneal astigmatism, but frequently has an oblique relationship with the corneal defect. There is also a distinct possibility of an independent astigmatic curvature at the posterior surface of the cornea.

Javal laid down certain rules as to the relationship between corneal curvature and subjective astigmatism. If the ophthalmometer indicated equality between all the corneal meridians, there would be almost always an inverse subjective astigmatism of one half or three fourths of a diopter. If the corneal astigmatism was inverse, one half or three fourths of a diopter would need to be added to the ophthalmometric measurement to arrive at the required correction. If the ophthalmometer showed direct astigmatism of between one and two diopters, it would be necessary to deduct one half or three fourths of a diopter to arrive at the correcting cylinder. But the presence of approximately two diopters of corneal astigmatism as measured with the ophthalmometer was likely to correspond to a net astigmatism of the same amount; while higher ophthalmometric measurements were usually found to understate the subjective astigmatism, the understatement increasing in fairly direct relationship with the amount of corneal astigmatism as indicated by the ophthalmometer.

Jackson (Transactions American Ophthalmological Society, 1894, page 177) was able to state, from study of five hundred eyes, that only in 22.6 percent did the corneal astigmatism exactly equal in amount the total astigmatism. The meridians of corneal and total astigmatism in Jackson's cases corresponded exactly in

only 31 percent, or, adding those cases in which the direction of total was exactly the reverse of that of corneal astigmatism, correspondence between the principal meridians was found in 34.6 percent.

Marquez, the veteran Spanish ophthalmologist, formerly of Madrid and now of Mexico City, who has shown a life-long interest in exact refractive technique, reached conclusions somewhat similar to those of Javal, although pointing out the significance of an oblique relationship between the corneal and what he preferred to call residual astigmatism—the latter representing the balance between the corneal and the total subjective astigmatism.

Attempts have occasionally been made to explain the difference between corneal astigmatism, as measured with the ophthalmometer, and the total astigmatism measured by subjective tests, as due in large part to an "astigmatic accommodation," or a partial and local action of the ciliary muscle which is supposedly capable of changing the shape of the crystalline lens so as to compensate for the corneal astigmatism.

To those who always make a careful preliminary refractive measurement without cycloplegia, it is familiar experience to uncover an appreciably higher amount of astigmatism under cycloplegia than at the preliminary test. Those who believe in the existence of astigmatic accommodation by the ciliary muscle would go so far as to explain such a difference between the precycloplegic and cycloplegic tests upon the basis of ciliary accommodation.

It is necessary, however, to remember that, consciously or unconsciously, many astigmatic patients have acquired certain habits by which a sort of nonciliary accommodation for astigmatism is accomplished.

One of the most important of these maneuvers is partial closure of the eyelids. Such partial closure is more or less definitely associated with pressure on the eyeball by contraction of the orbicularis in coördination with partial contraction (a sort of check action) of the elevator of the upper lid. This effect of lid pressure is distinct from the merely stenopeic effect of a narrow aperture, and is sometimes demonstrable before any stenopeic change is produced.

It is worth while to remember that this extrinsic muscular act of accommodation, if it may be so called, is not always abolished under cycloplegia. Its influence may be decidedly lessened by instillation of a two-percent solution of cocaine a half hour before the cycloplegic examination is made. Sometimes the mere instillation of cocaine is sufficient, by its influence upon the orbicularis and elevator, to uncover the total astigmatic error in such cases without any use of the drugs more properly classed as cycloplegics. This use of cocaine is often beneficial not merely in difficult cases of astigmatism, but in cases of myopia, where the same tendency to lid pressure upon the eyeball is frequently encountered as a complication.

It has been remarked that no one has absolutely proved the existence of astigmatic accommodation. It is equally true that no one has absolutely proved that astigmatic accommodation does not occur. But most ophthalmologists who are themselves astigmatic and who have carefully studied the behavior of their astigmatic patients will probably lean to the opinion that the only genuinely accommodative or ciliary adjustment for astigmatism consists of a rapid alternation between accommodation for one and then for another plane of the conoid of Sturm; in other words that, so far as the ciliary muscle is concerned, the astigmatic eye can adjust for only one group of light rays at a time. It is probably this oscillation at great speed which explains the

large amount of fatigue, and the abundance of local irritative symptoms, experienced by very many astigmatic eyes.

In a recent paper, Cotlier (Anales Argentinos de Oftalmologia, 1941, volume 2, page 6) records a number of illustrative cases in which important amounts of astigmatic accommodation were suggested by the facts that vision was unity with several different strengths of correcting cylinder, and that the lines of an astigmatic clock dial were also seen as equal under such varying cylindric corrections.

Whenever a series of refractive case reports speak of corrected vision being "unity," many American ophthalmologists will be disposed to wonder how much precision was used in the technique of examination, for many of us are in the habit of working to an improvement of the patient's vision much beyond unity as defined by Snellen, 20/16 being usual and 20/12 not uncommon.

"Eyelid accommodation" will go far to explain such cases as are mentioned by Cotlier, although we must perhaps admit the possibility of a real but quite limited astigmatic accommodation by the ciliary muscle.

Another question which will arise in the minds of many is as to how completely the patient's hyperopia was uncovered during these tests of the accommodating eye; for where the accommodation has not been adequately relaxed by skillful use of the fogging method (including especially bilateral fogging) the hyperopic eye is almost certain to resort to oscillatory variations of accommodation for the opposite radii of the clock dial or for the different parts of test letters.

An interesting indication as to possible incompleteness of technique in testing the accommodating eye is to be found in Cotlier's assertion (which to most of us will seem highly apocryphal) that the emmetropic eye becomes functionally hyperopic to the extent of one diopter when its accommodation is paralyzed with atropine.

A third source of error is constituted by frequent lack of precision in establishing the astigmatic axis, for the eye will often fail to show the full amount of the astigmatic error until the axis has been accurately established.

From discussing astigmatic accommodation, Cotlier passes to a repetition of the views of Marquez (apparently quite widely accepted in Ibero-America) concerning "biastigmatism." (The reader is referred to comments on this subject in the American Journal of Ophthalmology, 1930, volume 13, page 906; and 1931, volume 14, page 160.)

Briefly, Marquez's argument is that the estimation of astigmatism may be rendered more precise by leaving in the trial frame the cyclindric correction as shown with the ophthalmometer, and then adding a separate cylinder of such strength and axis as are indicated by the clock dial.

Marquez points out that the combination of these two elements, the ophthalmometer cylinder and the residual cylinder, with their independent strengths and axes, will yield a total cylinder strength intermediate between the steps found in trial-case lenses, as well as an intermediate axis. But in arguing for the greater refinement obtained by these intermediate fractions, he overlooks the fact that the separate trial-case cylinders which he uses, even at intervals of one-fourth or one-eighth diopter, will hardly ever represent the precise natural fractions of error, which latter must of necessity vary between these artificial fractions. The compounding of two such margins of error (between the natural and artificial fractions) will result in a greater margin of error than when a single cylinder is used in the trial frame to measure the

total astigmatic error of the eye.

Marquez and his followers also appear to display an exaggerated faith in the accuracy of the evidence obtained from tests with the "clock dial." Those who have carefully checked, one against the other, the astigmatic results with the clock-dial type of astigmatic chart and the results arrived at with the cross cylinder, have discovered that a small percentage of eyes give a decidedly false and misleading measurement with the astigmatic dial and a much better measurement with the cross cylinder, as judged by the visual result; although it is also true that some eyes give more reliable results with the dial than with the cross cylinder. In most hands, also, the usual "clock dial," with its thirty-degree intervals, is sadly lacking in precision as to astigmatic axis.

Although even Donders pointed out and no one now denies the presence of what Marquez has called biastigmatism, the practice of measuring and prescribing two separate astigmatic corrections is unnecessary and cumbersome. Only such astigmatism as can be stated in terms of the difference between two meridians at right angles with each other is capable of correction with a spectacle lens.

The most accurate refinements upon preliminary tests with the retinoscope or ophthalmometer are to be obtained by critical use of the fogging method in combination with the cross-cylinder test for axis, and either the cross-cylinder test or the rotatable-cross test for astigmatic strength.

W. H. Crisp.

THE EDUCATION AND TRAINING OF OPHTHALMOLOGISTS*

Interneship. Immediately following medical-school training, an interneship in a general hospital with a rotating service is probably the most satisfactory preparation for an ophthalmologic interneship later. This should be for not less than one year nor more than a year and a half. Such service permits, in a limited way, the practical application of the principles learned in the medical school, and is broad enough to include many of the main subdivisions of medicine. Next in desirability is the medical interneship, and a third choice would be the surgical first year.

Ophthalmologic training may be best begun by an interneship in an eye hospital closely associated with a general hospital, or in a general hospital with adequate eye staff and equipment.

Several factors are necessary in order that the maximum good may be obtained from such an interneship. Obviously, a sufficient number of beds devoted to ophthalmology is an essential, and an adequate clinic with well-qualified instructors in attendance is a requisite. Lectures covering the basic subjects and laboratory work must be included. These didactic lectures and the laboratory work should be given over a period of from 8 to 10 months, averaging about two or three hours a day. This permits time for digestion of the material. Much of the house officers' time should be devoted to refraction, for this is the most important element in the practice of ophthalmology. If it is not possible to get basic training during the year of interneship, this should be obtained by a shorter but more intensive course preceding the interneship.

Residency. The ophthalmic interneship should be followed by at least a year of residency; better two years. During this time considerable work with private patients should be done, for only with this class of patient is it possible to learn and practice refined refraction, efficiency in which is essential to success in ophthalmology. Teaching opportunity should be

* Read at the meeting of the American College of Surgeons in Boston, November 6, 1941.

given to clarify the ideas of the beginning ophthalmologist and to increase his experience as a teacher, since most well-trained physicians have the opportunity and the obligation on occasion to give courses or in some way transmit the benefit of the advantages that they have had. During the years succeeding interneship some research should be done—as much as is compatible with other work. Not all men are fitted for research, but for those who have this type of mind encouragement should be given in order to lay a foundation for later and more important investigation. A poor substitute for this is the working up of a case with a review of the collateral literature and presenting it as a small subject in itself. The idea of writing just for the sake of appearing in print is to be discouraged.

Most men who enter ophthalmology hope to be ophthalmic surgeons. Perhaps this will not so eventuate, but they should certainly be given the preliminary training of a surgeon. From 100 to 200 major operations should be performed by the resident, under proper supervision.

Graduate training. Not everyone will be able to pursue the ideal program as outlined. For those who cannot, some other method must be provided. Long basic courses are probably the best substitute, but these should be followed by an ophthalmic interneship or its equivalent. Such basic courses of eight months have proved very satisfactory in the Washington University Department of Ophthalmology. Students have been of a high caliber, have done good work, and have received an excellent foundation; and almost all of them have followed this course with an interneship. This type of training, however, has a limited application because of the necessary financial outlay. Furthermore, a large number of such courses will probably never be offered, because in few places can an adequate teaching staff be gathered. If these courses involve lectures only and not the actual treating of patients, a considerable number of students can be taken care of, but if the far better system of working with patients, performing refractions, and giving treatments is followed, only a smaller group can be handled.

Home-study courses. These should cover the same fundamental subjects as are found in the long basic courses. They have become popular since being started two years ago and promise a good future. About 400 enrolled in the courses given by the American Academy of Ophthalmology and Otolaryngology last year. This method of studying while pursuing one's other work appeals greatly to the practitioner and is reasonably satisfactory. The expense is relatively small. The lack of the almost essential clinical teaching is their greatest defect. There seems to be no reason why they cannot be worked out to provide a fair preparation for interneships in which it is impossible to offer such basic courses. As now arranged, a great deal of coöperation by the profession is necessary in correcting the papers submitted by those enrolled. If the idea works out, however, it should be possible to pay instructors for this labor. The knowledge acquired through these courses will be somewhat theoretical, and much of their efficacy will depend on the conscientiousness of the student, but none the less they will probably prove useful in filling a difficult gap in the teaching structure.

Short postgraduate courses. During the last few years throughout the country there have been established half a dozen very fine short courses varying from one to two weeks in duration. It has been possible to enlist experienced ophthalmologists with knowledge of a wide variety of subjects as instructors. These short intensive courses have aided many oph-

thalmologists in brushing up their knowledge. They are not of so great value to the beginner in ophthalmology as to a man well conversant with the subject. They have been justly popular and should continue to improve through the years.

One of the most encouraging features in the practice of ophthalmology has been the availability of better opportunities for training. Much of the credit for this must go to the encouragement, direction, and stimulation that have emanated from the American Board of Ophthalmology and the national ophthalmic societies.

Lawrence T. Post.

BOOK NOTICES

CANCER OF THE FACE AND MOUTH, DIAGNOSIS, TREATMENT, SURGICAL REPAIR. By Vilray P. Blair, M.D., Sherwood Moore, M.D., and Louis T. Byars, M.D. Clothbound, 599 pages, 260 illustrations, 64 plates. Saint Louis, C. V. Mosby Company, 1941. Price $10.00.

Every ophthalmologist of experience has occasionally encountered cases of cancer of the lids, eyeball, and orbit. There are times, too, when he is called upon to help solve the problem when his territory has been secondarily invaded by cancer arising in the adjacent structures. These are major problems not only because the successful removal means an opportunity to save life, but also because secondary plastic repair means the restoration of the patient's confidence and proper outlook on life. The wide experience of the authors of this book justifies the respect of the medical profession. In the introduction, Dr. J. M. T. Finney says, "the many recent advances and improved claims that have been made in the treatment by radiation of cancer of the face and mouth are so varied and of such far-reaching effect on surgery in general as to justify bringing them together in one volume for the benefit of those interested."

The first three chapters have to do with general considerations of treatment, underlying principles of surgical removal, and the care of the patient. Chapter four discusses cancer of the face. These chapters should be of interest to all ophthalmologists. The ophthalmic surgeon will be practically engrossed by chapter seven, which deals with cancer of the orbital structures. It is well illustrated with examples of typical cases and presents solutions in sufficient detail for the many problems encountered. At the end of the book are to be found diagrammatic sketches illustrating the surgical procedures. Plates 21 to 30 are pertinent to the ocular field. The sketches are disappointing at first glance but improve on careful study and fulfill adequately their purpose. There is a good index.

Derrick Vail.

CUESTIONES OFTALMOLOGICAS (Ophthalmologic questions). Summaries in English. By Manuel Marquez, Professor of Ophthalmology in the Medical Faculty of Madrid, etc. 369 pages, 203 illustrations in the text. El Colegio de Mexico, 1942. Price not stated.

The name of Manuel Marquez is familiar to all ophthalmologists who are acquainted with the international literature of ophthalmology. Having spent most of his professional life in Madrid, he is now, presumably as the result of the Fascist revolution in Spain, a voluntary exile from his native land, and practices ophthalmology in Mexico City.

The present volume is a series of postgraduate lectures delivered in the Department of Medicine of the University of

Mexico in the summer and autumn of 1939. It presents a restatement of the author's views and experiences on many topics, as expressed during his long career as Professor of Ophthalmology in Madrid.

Each lecture is followed by summaries in Spanish and English. The subjects of the 22 lectures include: astringents and caustics, mydriatics and miotics, dioptrics, Purkinje images, the use of convex-lens systems for the highly myopic eye, skiascopy, biastigmatism, ophthalmic neurology, normal and pathologic ocular dynamics, nerve control of ocular movements, decussation of the pupillary fibers, stereoscopic vision, the work of Ramon y Cajal, ophthalmologic questions in art and literature, and ethics.

For those who are fortunate enough to possess a reading knowledge of the Spanish language, these lectures are eminently worth reading. They are composed in the best of lecturing style, elegant, yet almost conversational, clear and straightforward in statement. Even though the reader may not agree with special opinions, he will always find an abundance of alert, penetrating, and constructive thought and a wealth of experience.

In a pupil and ardent admirer of the "maestro de maestros," Ramon y Cajal, it is not surprising to find very thorough treatment of ophthalmic neurology. The whole volume is well illustrated, but particularly so are these chapters on neurology, a subject in which Cajal himself was a pioneer. Excellent also are the chapters on ocular dynamics or motility and on binocular vision.

Most North Americans will fail to accept the theoretic basis of Marquez's views on what he has called "biastigmatism," but there can be no question that the author's enthusiasm for this topic indicates a worthy spirit of thoroughness in the greatly neglected art of refraction (see incidental comment on this subject in the editorial entitled "Astigmatic accommodation: biastigmatism" in the current issue of the American Journal of Ophthalmology).

Many of us, who have not had the good fortune to know him in the flesh, regret greatly that Professor Marquez was unable to fill his engagement to appear at the last meeting of the American Academy of Ophthalmology and Otolaryngology.

W. H. Crisp.

THE PHYSIOTHERAPY OF THE EYE DISEASES. By Stephen de Grósz. 80 pages, 33 illustrations. Budapest, The Hungarian Medical Publishing Company.

In this small comprehensive booklet the author gives us a perspective view of the whole field of physiotherapy. Not only does he describe the various apparatus used in physiotherapy, but teaches us how to use them advantageously, indicating the correct dosage of radiation, for instance, for each apparatus used in the treatment of each disease. Since many authors advocate the use of different physical agents for the same disease, we are indebted to the author for having made an authoritative selection of the best physical agent for a certain disease, based on his own great experience and on the survey of an extensive literature.

Ultraviolet rays are used in the form of local radiation, mainly in tuberculosis of the conjunctiva and superficial ulcers of the cornea, furthermore for indolent, degenerative, and marginal ulcers; in the form of general radiation for phlyctenules and tuberculous disease of the eye.

Diathermy has its value in the treatment of vitreous opacities, scleritis, and acute iritis and cyclitis. It is contraindicated in acute purulent infections of the

bulbus and adnexae, and in all forms of glaucoma, moreover, when a tendency to retinal hemorrhage is present. Strangely, the chief indications for short-wave therapy are the acute purulent infections of the lids, orbits, and, most of all, acute purulent dacryocystitis, although it will not make superfluous the subsequent use of surgery. As supplementary to the regular treatment short waves are beneficial in episcleritis, corneal herpes, acute iritis, inflammations following trauma or surgery, retrobulbar neuritis, and neuralgia. Neither short-wave therapy nor diathermy are of any use in affections of the posterior segment of the eye.

Radio-heat therapy, which is gaining in praise for the treatment of general paresis, has no place in ophthalmologic practice. It does not cure optic atrophy of tabetic origin, and for the treatment of other diseases we have simpler means at our disposal to achieve the same results.

The X ray is recommended for the treatment of tuberculous affections of the anterior segment of the eye. The protracted fractional method is preferred. The use of radium is restricted to angioma of the lid, conjunctiva, and retina, carcinoma of the lid, and inoperable carcinoma of the orbit. Only in one-eyed persons should sarcoma or glioma be attacked with radon seed. Even then, if the tumor is circumscribed, diathermy coagulation is to be preferred. Only in severe cases of vernal catarrh, when the vegetation is excessive and other means have failed, should radium be applied. After removal of an orbital tumor radiation of the orbit with radium is indicated. Radium is contraindicated in all inflammatory conditions.

Iontophoresis finds a thankful field in the treatment of corneal herpes and pneumococcus ulcer, with zinc, chloride, or iodide, and of episcleritis with salicylate and histamine; adrenalin for secondary glaucoma and atropine iontophoresis in uveitis.

The monograph is well written and will help to win many friends for physiotherapy which is still looked upon askance by many ophthalmologists.

R. Grunfeld.

CORRESPONDENCE

Transposition of the extraocular muscles

To the Editor,
American Journal of Ophthalmology:

Since 10 years ago, when I first learned of the experiments of Marina, I have been greatly perplexed. On reading the excellent paper by Leinfelder and Black, in your October issue, I became still more greatly perplexed, for these investigators thought they had proved that even in the dark a monkey could within a few days interchange the functions of two ocular muscles of the same eye. In spite of their results, which I do not seriously question, I was and still am unable to believe that any monkey is endowed with the ability to do this, hence my extreme perplexity. I need not give all my reasons, but one of them is the fact that normally the conjugate relationship of the eyes is so firmly fixed that it can be altered only by the bifixation mechanisms, and by these only partially.

Shortly after reading their paper, a possible explanation occurred to me, which, since I can conceive of no other, now seems to me almost a fact. Therefore, unless it is conclusively disproved, I shall continue to believe it.

This explanation depends upon the fact that each pair of transposed muscles must have crossed each other somewhere in the orbit, probably near the globe. At the same time each muscle must have carried with it and put under tension, check

ligaments and portions of Tenon's capsule which together could exert some traction in the direction of the original pull of the muscle. Hence, when, for instance, a transposed internal rectus contracted, it would press upon and pull upon the transposed inferior rectus, and also pull upon some of its own original attachments, so that the end result might closely resemble the usual inward effect.

The only difficulty here is that it would be expected that each transposed muscle would exert some pull in the direction corresponding to its new attachment. This difficulty, however, is so slight in comparison with that of accepting the assumptions of the investigators, that I shall completely ignore its possible importance until the difficulty has been proved to be insurmountable. Possibly such pulls did occur, but the monkeys did not permit them to be observed.

That cutting the superior oblique interfered with the supposed new coördination, presents no difficulty. This procedure seriously affects the coördination even when no other muscle has been disturbed. Therefore, it would be expected to do so more seriously, when some of the other muscles had been greatly distorted in the ways I have indicated.

Satisfactory proof, but not satisfactory disproof, of this explanation might be obtained by approaching the orbit from behind, after killing one of the monkeys, and then exerting traction upon one of the transposed muscles.

(Signed)
F. H. Verhoeff

Editor,
American Journal of Ophthalmology:

I have read with interest Dr. Verhoeff's comments concerning our work on muscle transposition in the monkeys. I do not feel that we are yet able to come to any definite conclusions concerning this work, although I do not at this time believe that Dr. Verhoeff's explanation applies.

In making the operations upon the muscles, particular care was exerted to free the muscle from Tenon's and the check ligaments. This should prevent these structures from causing a restoration of function. Our work is being continued, and I hope that in the near future we shall be able to present additional information on this interesting problem.

It has been called to my attention that there is an error in the table on page 1118. The last three eyes mentioned in that table had the four recti muscles transposed and the superior oblique muscle resected. As the table reads, one would infer that only the medial and inferior recti were transposed.

(Signed)
P. J. Leinfelder.

ERRATA

Due to an error in transcription, in the News Items of October, 1941, reference was made to the "National Society for the Prevention of Blindness of Great Britain." The item presented was from the last annual report of the National Society for the Prevention of Blindness, Inc., which has its headquarters in New York. As far as we know, there is no such society in Great Britain.

ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

ASSISTED BY DR. GEORGE A. FILMER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

1

GENERAL METHODS OF DIAGNOSIS

Ballantyne, A. J. **The histological interpretation of appearances in the fundus oculi—a scheme for methodical investigation.** Brit. Jour. Ophth., 1941, v. 25, Oct., pp. 480-493.

Methods of examination are described which, while not new or original, have a definite sequence and afford a completeness of record usually lacking. The author points out that much hidden information may lie between the ophthalmoscopic examination and the examination of paraffin or celloidin sections, and that by serial application of the methods described a survey of the normal or abnormal histology may be obtained. (Figures, references.) D. F. Harbridge.

Bettman, J. W., and McNair, G. S. **A portable slitlamp.** Amer. Jour. Ophth., 1941, v. 24, Oct., pp. 1190-1192.

Cogan, D. G. **A simplified entoptic pupillometer.** Amer. Jour. Ophth., 1941, v. 24, Dec., pp. 1431-1433.

Drews, L. C. **Autofundoscopy.** Amer. Jour. Ophth., 1941, v. 24, Dec., pp. 1403-1417.

Heath, Parker. **Apparatus facilitating study by biomicroscopy.** Amer. Jour. Ophth., 1941, v. 24, Dec., p. 1433.

Jancke, G. **The significance of ocular characteristics in the diagnosis of single-ovum twins.** Graefe's Arch., 1940, v. 142, pts. 1 and 2, pp. 113-155.

A total of 144 pairs of twins were examined as to the similarity of various ocular characteristics. The slitlamp appearance of the iris was found to be the most important characteristic in diagnosing single-ovum twins. The eyebrows and eyelids were identical in a large proportion, but the eyelashes, eyegrounds, and various measurements of the eye (palpebral fissure, interpupillary distance, exophthalmos and size

of the orbit), were less-reliable criteria. Similarities of the lens were the least characteristic. Identical twins can be diagnosed only if the irises are identical, as well as a majority of the other characteristics. Frances C. Cogan.

Lobeck, E. **Measurement of diameter of retinal arteries in living eye.** Graefe's Arch., 1940, v. 142, pt. 3, pp. 241-261.

This article presents in detail a description of the design and use of the author's apparatus for measuring the diameter of the retinal arteries and other fundus structures. A split ocular similar to that employed with heliometers is used with the Gullstrand ophthalmoscope. Sizes are recorded as fractions of the disc diameter. The apparatus has been described previously (Amer. Jour. Ophth., 1927, v. 20, p. 652), but is again discussed in response to requests made to the author for more detailed information in its use. Emphasis is placed on common difficulties encountered. Details must be read in the original. Frances C. Cogan.

Lugossy, Gyula. **The practical value of the sedimentation rate in ophthalmology.** Graefe's Arch., 1940, v. 142, pts. 1 and 2, pp. 16-36.

The author investigated the sedimentation rate in 114 patients with ocular disease, using Westergren's method. In most diseases limited to the eye and its adnexa (dacryocystitis, gonorrheal ophthalmia, ulcus serpens, eye injuries), the sedimentation rate paralleled the intensity of the inflammatory process and returned to normal slightly in advance of clinical improvement. Disease of the lens had no effect on the sedimentation rate. In systemic disease in which the eye was incidentally involved (phlyctenular and interstitial conjunctivitis, uveitis, iritis, diseases of the vitreous, retina, and optic nerve), the sedimentation rate did not return to normal until the systemic process was cured. As a preoperative procedure in lens extraction the sedimentation rate was found to be a good index of the patient's general condition. The sedimentation rate is significant as an indicator of the course and prognosis of certain ocular diseases but has no significance for differential diagnosis.
Frances C. Cogan.

Ramsey, A. M. **The interior of the living eye considered as a biochemical laboratory.** Glasgow Med. Jour., 1941, v. 135, June, pp. 173-188.

The author outlines the development of ophthalmoscopy and gives a general discussion of the value of fundus examination in various systemic diseases. He urges more extensive use of the ophthalmoscope in general medicine. T. E. Sanders.

2

THERAPEUTICS AND OPERATIONS

Bahn, C. A. **The most useful and inexpensive ophthalmic knife.** Amer. Jour. Ophth., 1941, v. 24, Nov., pp. 1309-1310.

Berens, Conrad. **Black and white silk sutures.** Amer. Jour. Ophth., 1941, v. 24, Oct., pp. 1192-1193.

Lorhan, P. H., Guernsey, G., and Rannie, P. **Pentothal sodium in relation to ophthalmologic procedures.** Current Researches in Anesthesia and Analgesia, 1941, v. 20, Sept.-Oct., p. 277.

The authors, heads of a university anesthetic service, give a short discussion of various anesthetic agents in ophthalmology. Pentothal sodium (intravenously) in eye surgery offers relief from psychic difficulties, a safe

and controllable anesthetic, absence of eye movements, and low incidence of postoperative nausea and vomiting. The related literature is listed. Preliminary medication with morphine and atropine is essential. Administration is described. A table analyzes 344 cases as to sex, age, premedication, postoperative complications, and the types of ocular surgery performed. There were no fatalities.

Robert O. Sherwood.

Meek, R. E. **Applied anatomy of the eye. Its relation to ophthalmic surgery.** Arch. of Ophth., 1941, v. 26, Sept., pp. 494-513.

The author reviews surgical anatomy and gives many practical and useful suggestions as to surgical procedures on the lacrimal system and the muscles, and in detachment of the retina and blepharoptosis. J. Hewitt Judd.

Miklos, Andor. **Pyrifer in ocular disease.** Graefe's Arch., 1940, v. 142, pts. 1 and 2, pp. 58-64.

The author discusses the advantages of pyrifer in nonspecific protein therapy of the eye, especially in gonorrheal ophthalmia. Pyrifer is a heteroprotein made from a nonpathogenic colon-bacillus vaccine and is administered intravenously. The chief advantages of pyrifer over other nonspecific proteins are that, in the usual dosages, it does not produce anaphylactic shock, abscess, or local pain, and its clinical effect is more energetic.

Frances C. Cogan.

Neuschüler, Ignazio. **The use of novocaine for infiltration in certain inflammations of the ocular adnexa.** Lettura Oft., 1938, v. 15, Feb., pp. 43-47.

Thirty cases of inflammation of the ocular adnexa (5 of hordeolum, 7 of suppurating chalazion, 4 of palpebral abscess, 11 of acute dacryocystitis, and 3 of phlegmon of the lacrimal sac) were treated by the simple method of injecting up to 3 c.c. of 0.5 or 1-percent novocaine into the inflamed tissues in the same manner as for local anesthesia. No other treatment was used. Within 12 to 24 hours signs of resolution were noted in nearly every case, and in the great majority there was almost complete resolution within 48 hours. The pain disappeared completely as soon as the injection was completed. Infiltrates, especially in early cases, were absorbed promptly (sometimes in less than 24 hours), and the course was much shorter than when other methods of treatment were used. Success was particularly marked in cases of acute dacryocystitis. The author has no explanation for the phenomena observed, but by way of hypothesis supposes that the novocaine acts by lowering the local p_H.

Harry K. Messenger.

Radzichovskii, B. L. **Subconjunctival implantation of catgut as a new therapeutic procedure.** Viestnik Opht., 1941, v. 18, pt. 4, p. 394.

Filatov attributes the therapeutic effect of tissue transplantation to the action of products of albumen decomposition and to the mechanical irritation of the surgical procedure. The products of albumen metabolism accumulate in the transplant during the period of conservation, as well as during the time that it lives in its new habitat. After becoming interested in this form of therapy the author found it difficult to find adequate material, and it occurred to him that catgut might be used. After implantation it undergoes complex biologic changes which (the author thinks) exert a

therapeutic effect on the surrounding tissue. The appeal of this therapeutic procedure is in its simplicity and in the availability of material. A segment of catgut suture is passed subconjunctivally above the upper limbus, the suture cut, and the ends pushed up and buried under the conjunctiva. The catgut is entirely absorbed in six or eight weeks. This procedure was used in 14 cases of trachomatous pannus, and was found effective in the cicatricial stages. In three cases of stubborn herpetic keratitis subsidence of the inflammatory phenomena and clearing of the cornea were hastened. Vision rapidly rose from counting of fingers to 0.1 or 0.2. Favorable effects were also observed in two cases of fresh corneal opacities, one herpetic and the other traumatic. In a case of scrofulous keratitis with frequent attacks there was no visual improvement, but there was no recurrence for seven months. The author concludes that the procedure has merit and deserves further investigation. (Illustrations.) Ray K. Daily.

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Appel, Hans. **The adaptability of different color charts in serial examinations.** Klin. M. f. Augenh., 1941, v. 106, April, pp. 452-454.

The Stilling, Ishihara, and Podestà charts are compared. The Ishihara charts are the most reliable in discovering any degree of color blindness, but they are too easily memorized. The twentieth edition of Stilling's charts is quite reliable, and supplemental use of Podestà charts is recommended. (One table.) Gertrude S. Hausmann.

Bean, Dorf. **The eye and ear in aviation.** New Orleans Med. and Surg. Jour., 1941, v. 94, July, p. 29.

Bean discusses visual acuity, depth perception, muscle balance, and accommodation as related to aviation.

Theodore M. Shapira.

Blew, C. L. **The origin and history of ophthalmic lenses and spectacles.** The Military Surgeon, 1941, v. 89, Oct., p. 670.

This article is a complete summary of the history of ophthalmic lenses and spectacles. There is also a discussion of the glass-making art.

Robert O. Sherwood.

Crozier, W. J., and Wolf, E. **Theory and measurement of visual mechanisms. 5. Flash duration and critical intensity for response to flicker.** Jour. Gen. Physiology, 1941, v. 24, May 20, p. 635.

The authors of this quite technical article conclude that the results obtained are consistent with the theory of central, rather than peripheral, location of the dynamically recognizable elements in the determination of flicker. (Tables.) F. M. Crage.

Eames, T. H. **A new approach to testing the eyes of school children.** Amer. Jour. Ophth., 1941, v. 24, Oct., pp. 1170-1173.

Keil, F. C., Jr., and Root, W. S. **Parasympathetic sensitization in the cat's eye.** Amer. Jour. Physiology, 1941, v. 132, March 1, p. 437.

The authors investigated the responses of the pupil to acetylcholine after interruption of the preganglionic and postganglionic parasympathetic fibers. The normal pupil of the cat reacted only slightly to intravenous injection of 5 mg. of acetylcholine per kilo of body weight. Removal of the ciliary ganglion or the intracranial section of the third nerve resulted in

marked acetylcholine sensitization of the iris sphincter, which reached a maximum in about five days. Recovery of acetyl sensitization following instillation of pilocarpine suggests that the loss of sensitization is associated with increased choline-esterase activity.

Theodore M. Shapira.

Kogan, E. **Comments on color-perception tests in transportation workers.** Viestnik Opht., 1941, v. 18, pt. 4, p. 431.

The author believes that the Stilling, Ishihara, and Rabkin pigment tests disqualify an unnecessarily large number of people from occupations which do not require extremely precise color differentiation. At the present the same color tests are given flyers and drivers. The author contends that drivers do not need the fine precision in color perception necessary for flying, and should be given less rigid tests. He constructed a miniature signal semaphore, and of 300 people disqualified by the pigment test, 125 distinguished the signals, and 101 recognized red. Only 74 of the 300 could be justifiably excluded from engaging in driving as an occupation. The author urges a revision in the color requirements of transportation workers.

Ray K. Daily.

Mandelbaum, J., and Mintz, E. U. **The sensitivities of the color receptors as measured by dark adaptation.** Amer. Jour. Ophth., 1941, v. 24, Nov., pp. 1241-1252.

Pascal, J. I. **On ophthalmic lens transposition.** Amer. Jour. Ophth., 1941, v. 24, Nov., pp. 1308-1309.

Pascal, J. I. **Suiting the cylinder to the mirror in retinoscopy.** Arch. of Ophth., 1941, v. 26, Aug., pp. 265-267.

In retinoscopy the light emerging from an astigmatic eye tends to form two focal lines at different distances, one at the far point of each of the two principal meridians. To obtain neutralization, the two far points should be made real or myopic, if necessary, by overcorrection with plus lenses. With a plane mirror to bring out the astigmatic phenomenon, it is well to neutralize first the more myopic meridian with a sphere and then with plus cylinders to neutralize the less myopic meridian. With a concave mirror it is well to neutralize first the less myopic meridian with a sphere and then with minus cylinders to neutralize the more myopic meridian. The writer thinks use of minus cylinder with concave mirror, or plus with convex, is advantageous.

J. Hewitt Judd.

Seitz, C. P., and Rosenthal, C. M. **Effect of oxygen deprivation and strychnine administration on visual function.** Arch. of Ophth., 1941, v. 26, Aug., pp. 276-287.

The angioscotomata of four subjects were carefully plotted at sea level and at a simulated altitude of 17,500 feet, carried out in a Barach portable oxygen chamber. After three drops of a 1-percent solution of strychnine sulphate had been applied to one eye and three drops of water to the other, successive measurements of the scotomas showed that oxygen deprivation caused a widening of the defect although macular vision remained unaffected. Strychnine administered at sea level caused a marked narrowing of the scotoma in the treated eye, but no change in the untreated eye. Strychnine was found to counteract the widening of the scotoma resulting from 17,500 feet of altitude. No relation between minor variations in blood pressure, pulse, or

pupillary area and the size of the scotoma was apparent. It is suggested that more elaborate pharmacologic experiments be made before conclusions are drawn as to the mechanisms of angioscotoma. J. Hewitt Judd.

Williamson-Noble, F. A. **The problem of asthenopia.** Brit. Jour. Ophth., 1941, v. 25, Sept., pp. 397-417.

Types of asthenopia are discussed and the author outlines his forms of treatment, including orthoptic exercises and aniseikonic correction. (Figures, references.) D. F. Harbridge.

4

OCULAR MOVEMENTS

Berens, C., Elliot, A. J., and Sobacke, L. **Orthoptic training and the surgical correction of strabismus.** Amer. Jour. Ophth., 1941, v. 24, Dec., pp. 1418-1422.

Haessler, F. H. **The divergence impulse.** Arch. of Ophth., 1941, v. 26, Aug., pp. 293-308.

The author discusses the part played by a divergence impulse in binocular coördination and in the clinical entity known as divergence excess, which is characterized by exophoria, greater for distance than for near vision, excessive divergence, and usually normal convergence. With the severe grades there frequently develops exotropia, which at first is intermittent but finally becomes constant. Whether the condition of the 1 to 2 percent of patients who have similar manifestations but do not have exotropia is caused by the same factors in less degree has not been demonstrated. Exophoria is interpreted as latent divergence and as a deviation from the position of rest. Tests for exophoria actually give information only as to the position which the optic axes assume when stimuli for binocular fusion have been avoided as much as possible. Although exophoria is widely assumed to be a result of the opposing "forces," divergence and convergence, this has not been conclusively demonstrated and must be modified by at least two factors of great importance: the anatomic and mechanical factor, and the tonic impulses responsible for postural adjustment, which may or may not be organized into more highly integrated functional units, such as divergence. The divergence of the optic axes stimulated by abducting prisms is assumed to be a measure of a divergence impulse. Movements of the extraocular muscles are initiated and controlled by afferent visual and proprioceptive impulses. Probably no purposeful movement is executed without participation of either the frontal cortical area that takes part in voluntary ocular movements or an occipital area the integrity of which is necessary for the fixation reflex, fusional movements, and accommodation. It is under the control of these cortical centers that the motor nuclei and centers in the brain stem bring about integrated ocular movements. There is presumptive evidence that there are in the brain stem centers for such integrative unit functions as divergence and convergence. Three methods of treatment are used for patients presenting the symptoms of divergence excess; prisms for wear, surgical intervention, and orthoptic training. Neither prisms nor operative treatment can influence a hyperkinetic divergence function, therefore any improvement obtainable must be from orthoptic training. The purpose of orthoptic procedure is not strengthening of the muscles but reëducation of the neuromuscular system. Orthoptic treatments may be effective

through increasing the patient's awareness of the image from each eye, either by stimulating the patient's appreciation of the proprioceptive impulses from the extraocular muscles, or by increasing the permeability of the paths from the cortical centers and so stimulating the fixation reflex.

J. Hewitt Judd.

Hoffman, Lovell. **Effect of benzedrine on the oculogyric crises of Parkinsonism.** Brit. Med. Jour., 1941, May 31, p. 816.

Studies were made in 17 cases of postencephalitic Parkinsonism, using benzedrine combined with stramonium, hyoscine, atropine, and luminal in varying mixtures. Tables show the results of treatment with the combined drugs and with the drugs minus the benzedrine. It was concluded that benzedrine, even in small doses, may be expected to give relief in about 50 percent of the cases with oculogyric crises if administered with drugs of the belladonna group. F. M. Crage.

Leinfelder, P. J., and Black, N. M. **Experimental transposition of the extraocular muscles in monkeys.** Amer. Jour. Ophth., 1941, v. 24, Oct., pp. 1115-1119.

Linksz, A. **The stereoscope as an orthoptic instrument.** Arch. of Ophth., 1941, v. 26, Sept., pp. 389-407.

The author tells what can be achieved with any stereoscope, even if nothing is known about the optical principles involved; how to perform exercises with a calibrated stereoscope; and how by means of simple calculations accurate measurements may be made with the stereoscope if its optical properties are known. He gives a brief outline of the optics of the ordinary stereoscope and his method of measurement of heterophoria with the aid of the B_3 chart of Wells. This relative position of the eyes is used as the starting point of fusion exercises with stereograms of fixed separation and movement of the slide holder of the stereoscope. J. Hewitt Judd.

Malbrán, Jorge. **Anomalies of the vertical movements of the eyes.** Arch. de Oft. de Buenos Aires, 1940, v. 15, Feb., p. 65.

The author follows Bielschowsky's classification of vertical anomalies. The physiology of the vertical recti and oblique muscles is discussed in detail. Malbran finds the most frequent type of paralysis of the vertical muscles to be that of the superior oblique. The methods of examination are presented in detail and the importance of determining the paretic eye is emphasized. The differential diagnosis between ocular and ordinary torticollis is discussed; and the vestibular mechanism, as postulated by Nagel and elaborated by Hoffman and Bielschowsky, producing the abnormal positions of the head is described in detail.

Overaction of the inferior oblique may be congenital or acquired. In the congenital form there may be no paralysis of the extraocular muscles, while the acquired form is most frequently secondary to paralysis of the superior oblique.

The treatment of vertical strabismus is strictly surgical, and the merits of the various operations are discussed at length. Any postoperative residual strabismus may be later corrected by the weakening of the overactive inferior oblique, for which myectomy is superior to simple tenotomy. (Case histories, photographs, bibliography.)

Plinio Montalván.

Martin, Gerhard. **Eye movements as the cause of faulty piloting of airplanes, automobiles, and bicycles.** Graefe's Arch., 1940, v. 142, pt. 3, pp. 262-275.

Afferent innervation of the eye muscles is discussed according to the source of stimuli (labyrinthine, auditory, synergistic, reciprocal reflexes). The author describes three sets of experiments designed to show what effect eye movements have on body musculature, especially as regards airplane, automobile, and bicycle driving. In the first set the subjects were provided with controls similar to those used in steering airplanes, and pressures on the controls were recorded as the subjects looked in various directions. Labyrinthine effects were eliminated by holding the head rigid. No significant changes in pressure were noted. In the second set the same technique was employed but the subject continuously pushed and pulled the steering mechanism back and forth. It was then found that conjugate gaze to one side caused involuntary pressure on the steering mechanism (as much as 5°) to the corresponding side. Looking downward caused downward pressure while looking upward had no effect. No effect was noted on the foot control. In the third set of experiments a bicycle handle bar was used instead of the airplane control. Turning the eyes to one side resulted in contralateral rotation of the bar (as much as 5°) to the opposite side. According to the author, these involuntary movements are part of an ophthalmodynamic reflex from the body musculature similar to those previously shown from the arm. Frances C. Cogan.

Ohm, J. **The frequency and the track (Bahn) of nystagmus in miners observed over long periods of time.** Graefe's Arch., 1940, v. 141, pt. 6, pp. 604-620.

The author reports 75 cases of miners' nystagmus. These were classified into three groups. The first group of 8 cases had not worked in the mines for a number of years, the second group of 16 cases had worked continuously, 8 months to 14 years, and the third group of 51 cases had worked intermittently 9 months to 18 years. The frequency and amplitude of the nystagmus impulse was measured with a lever on the upper lid, as previously described by the author. The track of the nystagmus (vertical, horizontal, rotatory, direction of gaze) was also determined. As far as possible the lighting was controlled.

In the first group it was usually found that the frequency increased and the amplitude decreased as the nystagmus improved. In no case did the reverse relationship occur. The time of disappearance of the nystagmus was proportional to its severity and not to the length of time in the mines. Of the 67 cases in the second and third groups, 31 showed either no apparent change or else a decrease in the frequency, while in 19 cases there was an apparent increase. The remainder could not be determined. An increase of frequency greater than 25 oscillations per minute was attributed to a change in the track of the nystagmus or to variations in the examination conditions.

The author assumes that a rhythmic impulse of unknown frequency and amplitude normally flows from the vestibular nuclei to the nuclei of the extraocular muscles over a number of pathways. If the frequency is decreased and the amplitude increased in one of these pathways a nystagmus results. The track of the nystagmus

depends upon which central pathway is affected. Although the track and the amplitude may differ in each eye the frequency is always the same, showing that there is a binocular innervation for the nystagmus. A central pathway once involved does not change so long as the conditions of work remain the same, although another pathway may become affected simultaneously. The author believes that the constitutional organization of the central pathway, together with the conditions under which a miner works, determines which pathway will become involved and what type of nystagmus will result.

Frances C. Cogan.

Ohm, J. **Nystagmus.** 49th communication. Graefe's Arch., 1940, v. 142, pts. 1 and 2, pp. 65-67.

The author reports a case of miners' nystagmus in which the amplitude of the nystagmus was found to increase on accommodation rather than to decrease as is usually the case. The frequency of the nystagmus remained about the same for distant and near vision. The increase of the amplitude was found to be less with monocular vision than with binocular vision for near. This supports Hering's theory that more energy is necessary for binocular than for monocular accommodation.

Frances C. Cogan.

Ohm, J. **Nystagmus.** 50th communication. Graefe's Arch., 1940, v. 142, pts. 1 and 2, pp. 213-228.

The author reports the effect of changes in the direction of gaze on the frequency and the amplitude of the nystagmus of ten miners. The directions of gaze used in the experiments were to the left and right, and above and below. The energy was considered as being equal to the frequency of the nystagmus times amplitude. It was found in the majority of cases that the frequency increased from above to below and from left to right, while the energy and amplitude increased from below to above and from right to left. The author believes that that part of the nystagmus field which shows the lowest frequency and the highest amplitude and energy is the direction in which the miner looked most frequently under the conditions of his work.

Frances C. Cogan.

Quereau, J. V. D. **A simple instrument for testing vertical muscle balance at reading distance.** Arch. of Ophth., 1941, v. 26, Aug., pp. 291-292.

The instrument consists of a metal divider 5 cm. wide which, when slid over the edge of the reading card, projects about 20 cm. in front of the card and divides the print into two equal columns. The width of the divider is such that it obscures the opposite column for each eye and, if hyperphoria is present, the column of print seen by the hyperphoric eye will appear lower than that seen by the opposite eye. The amount of prism necessary to level the columns indicates the amount of hyperphoria present under normal reading conditions. The advantage of the test is that the instrument may be applied when the patient is holding the reading card at the distance and in the position to which he is accustomed.

J. Hewitt Judd.

Stark, E. K. **The role of home training in orthoptics.** Amer. Jour. Ophth., 1941, v. 24, Nov., pp. 1299-1304.

Szinegh, Bela. **Convergent strabismus in myopia.** Graefe's Arch., 1940, v. 142, pts. 1 and 2, pp. 176-184.

The author presents three cases of convergent strabismus with myopia. In each case there was a history of myopia in one parent and of convergent strabismus in the other. The author concludes that these factors are inherited separately.

Frances C. Cogan.

Wheeler, M. C. **Orthoptics.** Arch. of Ophth., 1941, v. 26, Aug., pp. 260-264.

Orthoptic methods give information about binocular function which with further experience should prove a valuable guide in operative treatment. Orthoptic training is on a much firmer footing than it was a few years ago, but its indications and limitations need further defining. It should be carried out only by a qualified technician with the proper equipment and under the supervision of an ophthalmologist. Practical difficulties greatly limit the routine application of orthoptic methods by the average practitioner. Research clinics should be conducted in as many institutions as possible, in order to build up a large series of data from which definite conclusions can be deduced. (Discussion.)

J. Hewitt Judd.

5

CONJUNCTIVA

Angyshevich, P. L., David, V. I., and Savitzkaja, H. V. **Methylene blue in the treatment of trachoma.** Viestnik Opht., 1940, v. 18, pt. 4, p. 418.

The authors are very enthusiastic about the effectiveness of methylene blue in trachoma. A tabulated report of one hundred eyes shows that in 60 percent of the cases corneal transparency increased, vascularization diminished, and visual acuity rose above 0.1. The results were a perfectly smooth conjunctiva in 29 percent of the cases; smooth cicatrization with some remains of hypertrophy in 50 percent; some hypertrophy and thickening of the tarsus in 20 percent; and no improvement in 1 percent. The conclusions are that a 1-percent aqueous solution of methylene blue for local application, and 0.5-percent solution for instillation at home are effective antitrachomatous remedies in the presence of infiltration, hypertrophy, and corneal pathology. The methylene blue is well tolerated and produces only insignificant symptoms of transient irritation; deep corneal ulcers and infiltration are not contraindications to this remedy. The even and smooth conjunctiva resulting from its use could not be attained with any of the other numerous antitrachomatous agents. In 80 percent of the cases good results were apparent at the end of a months treatment.

Ray K. Daily.

Handmann, M. **Spontaneous formation of cup-like grooves in the conjunctiva and episclera at the upper limbus.** Klin. M. f. Augenh., 1941, v. 106, April, pp. 483-485.

Two cases are reported with formation of grooves at the upper limbus. The grooves were round with a radius of 3.5 mm. The sensibility within one of these grooves was disturbed.

Gertrude S. Hausmann.

Lee, O. S., Jr., and Lum, F. K. **Gonorrheal ophthalmia. Treatment with a sulfanilamide derivative and injections of milk.** Arch. of Ophth., 1941, v. 26, Aug., pp. 268-275.

Seventeen children with epidemic gonorrheal ophthalmia were hospitalized and divided into three groups for comparative study of the effect of sulfanilyldimethylsulfanilamide and milk

injections. Combination of the two forms of therapy was found desirable, especially in cases of corneal complication. The one inactivates the invading organism while the other stimulates the defense mechanism so as to bring the condition more quickly under control. Under such combined therapy, five to seven days of chemotherapy with two injections of milk is probably sufficient to cure uncomplicated gonorrheal ophthalmia in the acute and subacute stages, without danger of relapse. Patients with corneal complications will require four injections of milk and possibly up to ten or twelve days of chemotherapy. J. Hewitt Judd.

MacRae, Alex. **A case of subconjunctival granuloma.** Trans. Ophth. Soc. United Kingdom, 1940, v. 60, p. 234.

In this case a diagnosis of chronic granuloma of the conjunctiva had been made in 1931 after examination of fragments of tissue. The condition remained the same for five years, but in 1940 the granuloma had entirely disappeared. Beulah Cushman.

Maddren, R. F. **Monilial conjunctivitis.** Amer. Jour. Ophth., 1941, v. 24, Nov., pp. 1307-1308.

Sweet, L. K. **Gonococcal conjunctivitis in children.** Jour. Pediatrics, 1941, v. 19, July, pp. 60-69.

Sweet reviews the results of treatment of 62 patients with gonorrheal conjunctivitis. Of 30 patients who received sulfanilamide, 24 showed rapid recovery. Thirty-three patients, including four who failed to respond to sulfanilamide, received sulfapyridine. A rapid recovery was experienced by 31. Three patients were treated with sulfathiazole; all responded promptly. Only one corneal ulcer developed, this being in a patient on sulfanilamide therapy. The author suggests that either sulfapyridine or sulfanilamide is definitely superior to any previously used agent in the treatment of gonorrheal conjunctivitis. Sulfathiazole merits fuller trial. T. E. Sanders.

Thygeson, Phillips. **Treatment of staphylococcic blepharoconjunctivitis with staphylococcus toxoid.** Arch. of Ophth., 1941, v. 26, Sept., pp. 430-434.

Eighty-three patients with staphylococcic blepharoconjunctivitis which had previously resisted local antiseptic therapy were treated by immunization with staphylococcus toxoid, the local treatment which had previously failed being continued in each case. Healing was obtained in 22 cases, moderate or marked improvement in 53 cases, and little or no improvement in 8 cases. The conjunctivitis in cases which became free from pathogenic staphylococci showed no tendency to recur, but in cases in which symptomatic but not bacteriologic cure was obtained it generally recurred in from three to six months. Hence the use of staphylococcus toxoid would appear to be indicated as a supplement to local treatment in cases of resistant staphylococcic blepharoconjunctivitis.

J. Hewitt Judd.

6

CORNEA AND SCLERA

Aliquò-Mazzei, Alessandro. **The treatment of pneumococcal ulcer of the cornea by means of optochine fluoresceinate.** Lettura Oft., 1938, v. 15, April, pp. 123-140.

On the basis of experimental study and of clinical tests made on about a thousand unselected cases over a period

of more than ten years, the author shows that the specific action of optochine is increased by combining it with fluorescein-sodium (uranin). The substance resulting from this combination has been designated by the author as optochine fluoresceinate, and appears to be a relatively stable salt, that is, a true chemical compound. This is used in the form of a 1 or 2-percent ointment. The superiority of this compound over other preparations of optochine appears to be attributable to: (1) the greater rate of its diffusion through the cornea because of the lipoidolytic action of the fluorescein, and (2) the sensitization or even destruction of the dehydrogenasic enzymes by the photodynamic action of the fluorescein, whereby the action of these enzymes is more readily inhibited by the optochine. In the majority of cases the results of this treatment could be called brilliant. The inevitable corneal scar was relatively thin and transparent, never larger than the original ulcer, and caused little irregular astigmatism. The author concludes that there is no therapeutic means more effective than optochine fluoresceinate for local treatment of pneumococcal ulcers. Harry K. Messenger.

Artiemiev, H. I. **The subconjunctival implantation of refrigerated cornea in the treatment of keratitis.** Viestnik Opht., 1941, v. 18, pt. 4, p. 384.

A review of the literature on therapeutic grafting of cadaver cornea preserved on ice. The procedure was introduced by Filatov in the form of keratoplasty, and in 1938 Kopp reported gratifying results from subconjunctival implantation of cadaver cornea in cases of parenchymatous, tuberculous, and herpetic keratitis. The author reports the clinical details of 25 subconjunctival implantations of preserved cornea at the upper limbus. The most convincing are those of parenchymatous keratitis, in which the operation was performed on the more involved eye, the other eye serving as a control. The stimulus to resolution was very definite. The author concludes that this procedure is an adjuvant to the therapy of nonsuppurative diseases of the cornea, and is particularly effective in parenchymatous keratitis.

Ray K. Daily.

Blumenfeld, H. O. **Local autohemotherapy in keratitis.** Viestnik Opht., 1941, v. 18, pt. 4, p. 373.

A review of the literature and a report of the author's clinical investigations. Three types of autohemotherapy were tried: combined intramuscular and subconjunctival blood injections in ten eyes, subconjunctival injections alone of blood withdrawn from the basilic vein in nine cases, and subconjunctival injections of preserved blood in six cases. The technique of subconjunctival injections consists of instillation anesthesia, and the injection of 0.2 to 0.3 cm. of blood. The injections are repeated at intervals of 2 to 5 days. On the basis of this clinical experience the author concludes that local autohemotherapy is more effective than parenteral autohemotherapy, and is decidedly superior to subconjunctival injections of preserved blood. It affords subjective relief and hastens epithelization of ulcers, obliteration of pannus, and absorption of hypopyon. It produces no improvement in the conjunctival process in trachoma, does not prevent recurrence of pannus, and is ineffective in corneal injuries. As the injected blood is absorbed fine scars are left between the conjunctiva and episclera. Ray K. Daily.

Friede, Reinhard. **Keratoplasty in total leucoma of the cornea. Replacement of the entire cornea with subsequent central keratoplasty.** Klin. M. f. Augenh., 1941, v. 106, April, 454-473.

Replacement of the whole cornea is recommended in cases of total or partial staphyloma, in flat total leucomas, and in eyes where the anterior chamber is still present but the whole cornea up to the limbus is opaque. The keratoplasty incision should be just inside the limbus. In case the transplanted cornea does not remain clear a central keratoplasty should be undertaken later. One of the most frequent complications is ectasia of the transplant. Operations to reduce intraocular pressure in order to prevent this complication are discussed. (Illustrations.)

Gertrude S. Hausmann.

Givner, F., and Agelhoff, H. **Stevens-Johnson disease with complete visual recovery.** New York State Jour. Med., 1941, v. 41, Sept. 1, pp. 1762-1765.

The authors report two cases of Stevens-Johnson disease, which is a very severe form of erythema multiforme with high fever, generalized eruption of the buccal mucous membrane, severe membranous conjunctivitis, and usually suppurative keratitis. The majority of the cases reported in the literature have marked loss of vision from corneal scarring or perforations with panophthalmitis, the organism usually being the staphylococcus. In the two cases reported there was no corneal involvement, the author attributing this to the use of sulfanilamide.

T. E. Sanders.

Klauder, J. V., and Vandoren, Eleanor. **Interstitial keratitis.** Arch. of Ophth., 1941, v. 26, Sept., pp. 408-429.

The report considers 532 patients with interstitial keratitis who were treated or observed for at least one year. Thirty percent of the patients with inactive interstitial keratitis previously treated had negative serologic reaction of the blood. Only 2.5 percent of the previously untreated patients had negative reactions. Other syphilitic manifestations were incident in varying degree. In 42 percent of the patients both eyes were involved either simultaneously or within one month of each other. The percentage with involvement of the second eye increased slowly to the tenth year, at which time the second eye was involved in 79 percent of the cases. The effect of different plans of treatment on final visual acuity with or without correction was studied. The forms of treatment included routine therapy (more than twenty injections of an arsenical or less than twenty injections in conjunction with a heavy metal), routine therapy with iodides, routine therapy with fever (malaria, mechanical fever therapy, or vaccines intravenously), and routine therapy with iodides and fever. Treatment was also classified as continuous, intermittent, and irregular. It appeared that treatment administered in the inactive stage of interstitial keratitis was of limited value in improving visual acuity. The importance of employing at least twenty injections of an arsenical in the active stage of the disease was emphasized. Arsphenamine and neoarsphenamine obtained approximately the same results. The administration of iodides unfavorably influenced final visual acuity in patients both with active and with inactive interstitial keratitis. Routine treatment supplemented with fever therapy was superior to other forms of treatment in preventing relapse. Of 55 patients thus treated only one had a relapse. Re-

lapses after other types of treatment ranged from 13 to 18 percent. Relapse was more frequent in patients treated with less than twenty injections of an arsenical than in patients treated with more than twenty injections. Continuous treatment was superior to intermittent or irregular treatment only in regard to the final visual acuity of the poorer eye, the former seeming to result in better final visual acuity. Best results were obtained in patients with active interstitial keratitis treated with an arsenical combined with the use of a heavy metal and fever therapy. This treatment resulted in the following final visual acuity (total eyes): excellent (20/30 to 20/20), 51 percent; good (20/50 to 20/40), 17 percent; fair (20/200 to 20/70), 22 percent, and poor (less than 20/200) and blind, 10 percent. The visual acuity (total eyes) of untreated patients (control group) was as follows: excellent, 24 percent; good, 27 percent; fair, 37 percent; and poor and blind, 12 percent.

J. Hewitt Judd.

Kotelnikov, F. C., and Melnik, D. A. **Auto-implantation of refrigerated skin in the treatment of trachomatous pannus.** Viestnik Opht., 1941, v. 18, pt. 4, p. 390.

The current surgical procedures for pannus, such as Denig's operation and its various modifications, are believed to derive their effectiveness from the mechanical barrier presented by the transplanted tissue. Filatov rejected this theory and attributed the effect to tissue trauma and tissue reaction to external irritants. On the basis of this theory the authors used the following procedure for pannus; a piece of skin was excised from the shoulder, preserved on ice for six days, and then implanted through a vertical incision under the skin of the temple, 1 cm. from the external canthus. Thirty operations were performed on twenty patients. Twenty of the operations produced gratifying results, six negative. In four cases the disease process was activated. In this procedure there was no local traumatism to the cornea, no interuption of the corneal vessels, and no mechanical barrier. The effect, favorable or otherwise, must be attributed to the action of the accumulated physiologic substances in the preserved skin on the trachomatous process in the cornea.

Ray K. Daily.

Kronenberg, Bernard. **Treatment of herpetic keratitis with ether.** Arch. of Ophth., 1941, v. 26, Aug., pp. 247-249.

This report is based on eight cases of herpetic keratitis treated with from one to ten applications of anesthetic ether. The ether was rubbed in well with a freshly dipped cotton applicator. The author states that there is no reaction or pain following this treatment. No definite explanation of the action of ether is given, but a chemical affinity is suggested. Two illustrative cases are briefly reported.

J. Hewitt Judd.

Napier, L. E., Kirwan, E. O'G., and Sen, G. **Eye complications of dermal leishmaniasis.** Indian Med. Gazette, 1941, v. 76, Sept., p. 542.

A patient showed typical nodules of dermal leishmaniasis following kala-azar. About 5 percent of such patients have the dermal nodules. A very rare complication existed in the form of corneal lesions, characterized by nodules at the limbus and in the cornea, pannus formation, and extensive vascularization. Leishmania were demonstrated in the limbal tissue. Iodides were not effective, but improvement was noted after antimony treatment.

It is to be noted that Duke-Elder's textbook describes a leishmanial keratitis. The authors feel that this is for Leishmania tropica (oriental sore) and not the Leishmania donovani of the above case where the lesions were undoubtedly hematogenous. Excellent illustrations are given.

Robert O. Sherwood.

Refalovich, C. H. **Sulfanilamide in the treatment of trachomatous pannus.** Viestnik Opht., 1941, v. 18, pt. 4, p. 414.

A review of the literature and an analysis of the author's clinical material. Two series of patients were treated; the hospitalized series were given massive doses of 0.05 gm. per kilogram of body weight; the ambulatory cases were given 1.5 gm. daily for seven days, at seven-day intervals, for six to eight weeks. The only untoward complication was an erythema in one patient. At the conclusion of the treatment most of the patients had a diminution in hemoglobin and leukopenia. In eleven patients there was complete obliteration of pannus, with cessation of all inflammatory phenomena, and marked visual improvement. Eight patients were considerably improved but six of these did not return for observation. In the other two the cure was not complete at the end of sulfatherapy, and other forms of therapy were instituted. One patient could not tolerate sulfanilamide, and its administration had to be discontinued. The conclusions are that the favorable effect of sulfanilamide on pannus is obvious; that the simplicity of administration and painlessness of application are factors worthy of appreciation; and that further observations are necessary to determine whether sulfanilamide can cure the conjunctival process.

Ray K. Daily.

Rones, B., and McKay, E. **Riboflavin therapy in nonvascular keratitis.** Medical Annals District of Columbia, 1941, v. 10, Aug., p. 290.

Apparently in the avascular cornea Warburg's yellow enzyme plays the major role in the oxidation system. As riboflavin is an important constituent of this enzyme a deficiency in riboflavin interferes with corneal oxidation. Acting upon this theory, together with the fact that riboflavin is easily inactivated in the cornea by light, the authors treated diverse corneal lesions with riboflavin and occlusion. Four cases of phlyctenular keratoconjunctivitis, three cases of superficial punctate keratitis, and five other miscellaneous cases of nonvascular keratitis were so treated. Improvement was definite in all of them, even those cases which had resisted previous forms of local therapy. The riboflavin apparently causes an acceleration of respiratory processes in the cornea.

John C. Long.

Seanson, C. A. **Keratoconus following corneal transplant.** United States Naval Med. Bull., 1941, v. 39, Oct., p. 549.

Swanson reports the case of a naval patient on whom Castroviejo did a corneal transplant. After a severe corneal ulcer resembling dendritic keratitis, the eye had healed with a resultant leukoma and vision of 20/200. About four weeks after surgery the transplant was clear and vision was 16/20. During the next two months a cyclitis was treated successfully. However, seven months later keratoconus developed with vision reduced to 20/200, corrected with a contact lens to 20/20. The other eye was normal. This is believed to be the first reported case of keratoconus following corneal transplantation.

Robert O. Sherwood.

Shereshevskaja, L. I. **The role of the superior cervical ganglion in the pathogenesis of keratitis.** Viestnik Opht., 1941, v. 18, pt. 4, p. 378.

A review of the literature fails to discovery conclusive data on the role of the superior cervical ganglion in the pathogenesis of keratitis. In 1937, Halpern of Speranski's laboratory produced experimental keratitis by injecting croton oil into the superior cervical ganglion. Kuvatov, in 1936, in the search for a procedure to prevent neuroparalytic keratitis following excision of the gasserian ganglion, found that injections of croton oil into the gasserian ganglion were followed by keratitis, but simultaneous injections into the gasserian ganglion and into the superior cervical ganglion were not followed by keratitis. Shereshevskaja's experimental study was made for the purpose of clarification of these contradictory views. Three series of experiments were made on rabbits: excision of the superior cervical ganglion, injection of the ganglion with alcohol or croton oil, and mechanical irritation by passing a thread through the ganglion and cutting the nerve below it. In each case there was a miosis on the operated side immediately following the operation, which remained during a five months period of observation. The animals did not develop keratitis, with the exception of one case in which a cervical gland was excised by mistake. The results of the experiment justify the conclusion that the superior cervical ganglion is not a factor in the pathogenesis of keratitis, and that there are other factors in the etiology of neuroparalytic keratitis beside injury to the sympathetic fibers of the trigeminal. Ray K. Daily.

Spezia, Carlo. **The treatment of hypopyon keratitis with platinum chloride.** Lettura Oft., 1938, v. 15, Feb., pp. 48-53.

The author describes three cases of hypopyon keratitis which were successfully treated with a 2-percent solution of platinum chloride, applied with a swab to the corneal lesion on three successive days. The solution was not neutralized as is done when tattooing the cornea. The infiltrative process was thereby immediately arrested. Re-epithelization took place promptly, and the resulting scar was sharply defined and of little density. The author believes that platinum chloride is effective by virtue of its caustic action. It has great penetrative power and is harmless to sound tissue. Only superficial anesthesia is required for its application. Harry K. Messenger.

Wichhusen, Hermann. **Investigation concerning the mechanical characteristics of the human cornea.** Graefe's Arch., 1940, v. 142, pt. 3, pp. 276-285.

The author reports experiments on the sclera similar to and performed with the same apparatus as earlier experimental study of the cornea by Nausch. The tensility of the excised scleral pieces was measured with an accuracy of 0.1 mm. The material was obtained from human cadavers 1 to 3 days post mortem and subjected to momentary and prolonged stretching with a pressure of 300 mm. Hg. Both the degree of tensility and the elastic return were recorded kymographically. Measurements were made on 40 scleras and the results are plotted according to age. The author concludes that tensility with momentary or prolonged force decreases with age but scleral elasticity shows no direct variation with age. Frances C. Cogan.

Wiener, M., and Rosenbaum, H. D. **Formalinized heterogeneous and homogeneous corneal transplantation—experimental.** Amer. Jour. Ophth., 1941, v. 24, Dec., pp. 1384-1391.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Aliquò-Mazzei, Alessandro. **The diagnostic value of Bercovitz' pupillary-reaction test for pregnancy.** Lettura Oft., 1938, v. 15, May, pp. 180-186.

Various biochemical tests for pregnancy are briefly discussed. Bercovitz' test consists in instilling a drop or two of the patient's blood or serum in the conjunctival sac of the patient, of other persons, or of experimental animals. If the reaction is positive a modification of the pupillary diameter is observed, more frequently a miosis, but sometimes also a relative mydriasis with respect to the other eye which serves as a control. The author uses citrated blood according to Pouliot's method, which he describes, and takes care to eliminate possible sources of error. Twenty-four women known to be pregnant were tested. In 18 of these (75 percent) the reaction was positive. Positive reactions were found in the first months of pregnancy as well as in advanced cases. Mydriasis occurred in eight instances, and miosis in ten. The anisocoria was always slight and of brief duration. The author also tested the same subjects using adrenalin instead of citrated blood, and found that in those cases where the blood caused mydriasis adrenalin did the same, and that adrenalin was without effect in those cases where the blood caused miosis or evoked no reaction at all.

The following conclusions are reached: The mydriatic effect is due to the presence in the blood of pregnant women of an adrenalin-like substance. A pupil-constricting substance may also be found. In some cases of pregnancy the balance between these two opposing substances may be such that the test is negative. He admits that these are simply hypotheses and that the whole question deserves to be thoroughly studied.

Harry K. Messenger.

Appelmans, M., and Van Horenbeeck, A. **The origin of uveoparotid fever.** Ophthalmologica, 1941, v. 102, Aug., p. 65.

The changes in uveoparotid fever are by no means limited to the structures mentioned in its name. Small nodular lesions occur in the conjunctiva, the cornea, and the lacrimal gland. They have a histologic structure similar to that of skin lesions in Boeck's sarcoid. The results of guinea-pig inoculations performed by the authors make it probable that the germ is present in the circulating blood in febrile periods.

F. Herbert Haessler.

Arisawa, Ryoiti. **Ophthalmologic studies with the virus of Japanese epidemic encephalitis. 3. Transfer of virucidal element.** Sei-i-Kai Med. Jour., 1941, v. 60, no. 7, pp. 908-940.

Adult rabbits were actively immunized with the virus, and the amount of virucidal elements in the aqueous humor and tears was measured. When the virucidal titer of the blood serum reached 400, the aqueous humor of the posterior chamber showed a 5 to 100 titer, but the anterior-chamber aqueous and the tears showed no virucidal element.

Shiro Tashiro.

Davson, J., and Weld, C. B. **Studies on the aqueous humor.** Amer. Jour. Physiology, 1941, v. 134, Aug. 1, p. 1.

On the basis of their work on dogs, the authors conclude that although filtration represents the primary process in aqueous formation, there is evidence of secretion being superimposed on this process. Theodore M. Shapira.

Endo, Sigeru. **The effect of perfusion of serum-albumen solution on the flow of aqueous humor in eyes.** Jour. Oriental Med., 1941, v. 34, pp. 1141-1165.

When a colloidal solution is perfused into the anterior chambers of rabbit eyes under pressure a few mm. Hg higher than the ocular pressure, a definite amount goes into the chamber for a time and then a reverse flow occurs. The perfusion pressure and pH influence this reverse flow, which is caused by the blocking of the excretory canal of the aqueous humor with the colloidal particles. Ringer's solution does not produce it.

Shiro Tashiro.

Friedenwald, J. S., and Buschke, W. **The role of epinephrine in the formation of the intraocular fluid.** Amer. Jour. Ophth., 1941, v. 24, Oct., pp. 1105-1114.

Gill, W. D. **Sympathetic ophthalmia.** Southern Med. Jour., 1941, v. 34, Sept., p. 959.

Gill reports 12 cases of sympathetic ophthalmia. In each case the immunologic properties of uveal pigment were investigated. It is believed that there is an allergic phase in each case, as there is also in pigmentary degeneration of the retina and in a form of posterior uveitis due to local infection. The complete pathology is not explained by hypersensitivity. There must also be a reaction similar to the Arthus phenomenon. Injury causes disintegration of the melanin pigment. A skin test is described for determining sensitivity.

Gill believes that uveal pigment hypodermically administered is the most valuable single therapeutic agent available. Tuberculin is of service as a nonspecific supplemental agent in stimulating antibody formation. Typhoid vaccine is similarly useful. Sulfanilamide has been used but no opinion is expressed regarding its effectiveness. Focal infections should be eliminated. The severity of the disease may be influenced by prompt diagnosis and treatment. Enucleation of the exciting eye is usually not advisable after both are inflamed as it may later be the better eye. Surgery in either eye is not well tolerated. Robert O. Sherwood.

Goldman, H. **A method for determining the volume of the anterior chamber of living man.** Ophthalmologica, 1941, v. 102, July, p. 7.

The author previously described (Amer. Jour. Ophth., 1940, v. 23, p. 709) a method of obtaining sharp photographs of the anterior chamber by exposing a moving film strip to the sharply focused part of the slitlamp beam as the latter moves through the tissue of the anterior chamber synchronously with the film strip. In the present report he describes a method of estimating the volume of the anterior chamber from a photograph of the largest cross section of the chamber. The anterior chamber may be considered a geometric solid generated by rotation of its axial cross section. By means of graphic rather than calculated integration, a factor of proportionality was developed and found to be 0.577. The author uses a 5× magnification of the photograph, a planimeter on which one mark is equivalent to ten square millimeters, and an

angle of five degrees. The details of derivation of the formula are described.

F. Herbert Haessler.

Hough, W. H. **Adie's syndrome in twins.** Med. Annals Dist. Columbia, 1941, v. 10, April, pp. 137-140.

The author reports Adie's syndrome in identical twins, white females, aged 22 years. The syndrome consists of a tonic or false Argyll Robertson pupil (usually unilateral) and absence of the tendon reflexes without evidence of any neurologic lesion. The presence in twins suggests an hereditary factor.

T. E. Sanders.

Kronfeld, P. C. **The protein content of the aqueous humor in man.** Amer. Jour. Ophth., 1941, v. 24, Oct., pp. 1121-1131.

Liebman, S. D., and Newman, E. H. **Distribution of sulfanilamide and its derivatives between blood and aqueous.** Arch. of Ophth., 1941, v. 26, Sept., pp. 472-477.

The results of animal experimentation indicate that the concentration of sulfanilamide and sulfapyridine in the normal rabbit aqueous is about two thirds the blood level. The concentration of sulfathiazole in the aqueous is only about one fifth that in the blood, while the concentration of sulfadiazine is one half that in the blood. The sulfanilamide compounds diffused into rabbit and into human aqueous in approximately the proportions found by other investigators in studying spinal fluid. The advantage of paracentesis in raising the level of the drug in the aqueous was demonstrated for the normal rabbit eye. A good correlation of the results of animal experiments was found in four human beings who were studied post mortem.

J. Hewitt Judd.

Lowry, J. T. **Iris changes in syphilis; further observation.** Southwestern Med., 1941, v. 25, Sept., p. 290.

(A summary of the previous report was given in the Amer. Jour. Ophth., 1941, v. 24, p. 1462.) The changes noted in the irises of patients with syphilis are further noted as: (1) an appearance of pitting in the outer segment of the iris, (2) a deepening of the inner segment of the iris, and (3) an eccentricity of the circulus iridis minor. The anatomy of the iris is reviewed. The author and others examined 1,769 patients and noted their findings in regard to age, relation to serologic tests, the stage of syphilis, the degree of changes seen, and the color of the iris. These signs are regarded as helpful in arousing suspicion of syphilis. They were accurate in 83.2 percent of the above cases. Robert O. Sherwood.

MacRae, Alex. **Case of ectropion of uveal pigment.** Trans. Ophth. Soc. United Kingdom, 1940, v. 60, p. 236.

Large areas of ectropion of uveal pigment were present extending from the pupillary edge of the iris. The pigmented tissue had 125 radial ridges and furrows evenly spaced.

Beulah Cushman.

Miklos, Andor. **The end results of iridocyclitis.** Graefe's Arch., 1940, v. 142, pts. 1 and 2, pp. 203-212.

The outcome of anterior uveitis in five hundred cases is recorded. It was found that 15 percent of the patients became blind in one or both eyes or had vision reduced to 5/100 or less (of this group, 78 percent were tuberculous). Another 13 percent suffered severe loss in vision. The author points out that uveitis localized in the iris has a good prognosis in comparison with chronic iridocyclitis. The third and

sixth decades were the ages in which the largest number of cases occurred especially in women. The cases of chronic uveitis occurring in patients between 40 and 50 years of age had the worst prognosis. Frances C. Cogan.

Miller, F. J. B. **A case of iridocyclitis with paralysis of the sphincter pupillae following varicella.** Med. Jour. Australia, 1941, v. 1, May 17, p. 614.

A 14-year-old boy convalescing from varicella developed iridocyclitis in his right eye. Associated with this inflammation, which was transient, was paralysis of the iris sphincter and of accommodation. The author could find no recent reference to such a case in the literature at his disposal.

F. M. Crage.

Olmsted, J. M. D., and Morgan, M. W., Jr. **Effects of adrenalin and acetylcholine on isolated iris muscle, in relation to pupillary regulation.** Amer. Jour. Physiology, 1941, v. 133, May 1, p. 106.

The authors confirm the inhibitory action of adrenalin on the isolated iris sphincter. They also cite evidence in support of the belief that in so far as sympathomimetic substances are concerned the pupil size is regulated largely through the sphincter component. Theodore M. Shapira.

Papkova, V. I. **Bilateral gumma of the iris.** Viestnik Opht., 1941, v. 18, pt. 4, p. 441.

A woman 30 years old, without other manifestations of tertiary syphilis, developed bilateral gumma of the iris, a deep punctate keratitis, exudates on the posterior corneal surface, and posterior synechia. The condition underwent resolution in the course of antiluetic therapy, leaving the iris at the site of the gumma atrophic. Bilateral gumma is a very rare occurrence.

Ray K. Daily.

Purtscher, E. **The influence of the tunica vasculosa lentis on the formation of spontaneous cysts of the pigment epithelium in the posterior chamber.** Graefe's Arch., 1940, v. 141, pts. 4 and 5, pp. 567-597.

Two cases of cyst of the pigment epithelium in the posterior chamber of the eye are reported. The first case was that of a unilateral microphthalmos with coloboma of the iris and choroid, dislocated lens, and a pigmented cyst in the posterior chamber closing the pupil. An iridectomy was performed and as much of the cyst wall as possible was removed. This tissue on microscopic examination showed some fibrous tissue attached to the posterior iris surface but no epithelium. Through the operative coloboma the ciliary processes were seen to be very much elongated and, toward the periphery of the eye, joined together to form a homogeneous membrane. The second case, which was examined microscopically, clarifies the first one. This was a unilateral microphthalmos with coloboma of the iris and choroid, dislocated lens, and a large pigmented cyst in the posterior chamber. The upper ciliary processes and part of the vascular layer of the ciliary body formed a thick homogeneous membrane or "curtain," elongated in the direction of the dislocated lens.

The author explains the formation of the abnormal ciliary processes and the pigmented epithelial cysts on the basis that stretching of embryonic tissue results in hypertrophy. He assumes that the ciliary processes were stretched between the growing ocular wall and the dislocated lens. Early adhesions be-

tween the pigment epithelium and the tunica vasculosa lentis, and the subsequent failure of the latter to atrophy completely, resulted in stretching of the pigment epithelium and the formation of pigmented cysts in the posterior chamber. Frances C. Cogan.

Sautter, Hans. **Hypoplasia of the dilatator of the pupil.** Klin. M. f. Augenh., 1941, v. 106, April, pp. 406-410.

The author reports five cases of hypoplasia of the dilatator of the pupil in one family. The width of the pupil in these cases was between 0.9 and 1.8 mm. Cocaine reaction was very slight and atropine only dilated to 2 or 3 mm. Sphincter paresis alone causes this much dilation. (One family tree, one table, 3 illustrations.)

Gertrude S. Hausmann.

Schmidt, Rolf. **Clinical picture of recurrent hypopyon-uveitis.** Graefe's Arch., 1940, v. 142, pts. 1 and 2, pp. 185-202.

Four cases are reported and discussed at length. All of them fulfilled the diagnostic criteria set forth by Gilbert and Weve in that the disease occurred exclusively in men, was bilateral, and gave a poor prognosis. The author suggests that there are intermediate cases not fulfilling these criteria. Extensive clinical examination of the four cases gave no definite indication as to the etiology. There was specifically no constant bacteriologic finding, and no hypersensitivity to the various antigens tested. One patient who died was found to have had a latent glandular tuberculosis. Histologic examination of one of his eyes showed a cyclitic membrane and an infiltration of the cornea and pars plana of the ciliary body with leucocytes, lymphocytes, and eosinophiles. Bacteriologic examination of the other eye showed a nonhemolytic streptococcus. One eye of another patient was also removed and showed infiltration of the iris and ciliary body with perivascular inflammation of the retina and optic nerve. The author concludes that various causative factors are probably operative. Frances C. Cogan.

Van Heuven, J. A. **Scattering of light on to the ciliary body by the lens.** Graefe's Arch., 1940, v. 142, pt. 3, pp. 319-325.

This article is concerned with the thesis of Van der Hoeve that the unpigmented epithelium of the ciliary body may be damaged by light scattered from the lens. To obtain a quantitative measure of the amount of light reaching the ciliary body, the author made a 1-square-cm. hole through the sclera into the vitreous in the region corresponding to the ciliary body. A spectrophotometer was then placed over the hole while the pupil was illuminated and the energy incident on 1 square cm. of the ciliary body was recorded as a function of the total energy entering the eye. The portion of light reaching the ciliary body is about 1 percent of the total light with predominance in the shorter wave lengths. This, on a bright summer day, would correspond to intensities of 3 lux with a 2-mm. pupil and 75 lux with a 10-mm. pupil. Is this sufficient to damage the ciliary epithelium? Normally the ciliary epithelium turns blue when exposed to methylene white, because of its oxygen content, but after irradiation with intensities that would produce 50 lux on the ciliary body, there is no staining of the epithelium. Decrease in oxygen formation after irradiation may also be shown, according to the author, by the analysis of nitrogen bubbles injected

into the posterior and anterior chambers. Normally there is a gradient of oxygen saturation amounting to 26 percent in the posterior chamber, 22 percent in the pupillary region, and 18 percent in the anterior chamber (variation 2 percent). After irradiation the oxygen content amounts to 11 percent in the posterior chamber and 8.4 percent in the anterior chamber. It is assumed that this decreased oxygen formation has some bearing on the cataract problem. Although irradiation with the intensities of light used decreased the oxygen secretion by the ciliary body, no effect was noted after section of the optic nerve, either immediately or after several weeks.

Frances C. Cogan.

Zwiauer, A. **Bone formation in the choroid.** Graefe's Arch., 1940, v. 142, pts. 1 and 2, pp. 68-81.

The author states that bone formation in the eye usually occurs in avascular cell-poor scar tissue which develops following severe inflammatory processes. The blood supply of the choroid is more likely than that of the ciliary body to be damaged in severe inflammations as the choriocapillaris is frequently destroyed. Likewise there is frequent parenchymal damage in the choroid. For these reasons bone formation is more likely to occur upon or in the choroid than the ciliary body. The author discusses seven cases (four in full) in which small pieces of noncalcified bone were found in the choroid adjacent to the optic nerve. There was no definite connective-tissue membrane but in four of the cases there was clear evidence of fibrous changes in the choroid. It is suggested that the inflammatory stimulus traveled from the anterior segment of the eye through the hyaloid canal to the optic nerve and to the surrounding choroid. Two further cases are reported of bone formation in the choroid not contiguous with the optic nerve. In one case the choroid as well as the rest of the eye was atrophic and fibrous. The other case showed bone formation a short distance from the optic nerve in an eye which had been injured only 3½ months previously and in which there was no severe intraocular inflammatory process at the time of removal. The choroid was histologically normal. The bone formation in this case could not be explained by the author. The author thinks it probable that osteoblasts in the blood stream settle in tissue suitable for growth, which in most cases seems to be avascular scar tissue.

Frances C. Cogan.

8

GLAUCOMA AND OCULAR TENSION

Aliquó-Mazzei, Alessandro. **Carbaminoylcholine (doryl) in the therapy of glaucoma.** Lettura Oft., 1938, v. 15, Aug., pp. 283-307.

The author presents his study of the miotic and hypotensive action of carbaminoylcholine as prepared for opthalmic use in aqueous solution under the name of doryl. Twenty-six persons with glaucoma were studied, some with chronic simple glaucoma, others with congestive glaucoma, and a few with secondary glaucoma. The diminution in tension was marked in primary glaucoma except in one or two cases in a most advanced stage; on the other hand, it was negligible in secondary glaucoma. In acute glaucoma the use of doryl relieved pain, favored the reabsorption of corneal edema, and often resulted in a lowering of the tension to a notable degree. It did not always cut short the attack, but frequently

lowered the tension to a point where surgical intervention was much facilitated. The best results were obtained in chronic simple glaucoma. The hypotensive action of the drug was observed to be not in direct ratio to the miosis. The former lagged behind the latter, and was of greater duration. Sometimes the hypotensive effect was marked where the miosis was slight. The author concludes that the hypotensive effect of doryl and other miotics is due chiefly to vasomotor changes particularly in the capillary permeability. Hence the mechanism of the action of doryl squares perfectly with the neurovegetative theory of glaucoma. No intolerance for doryl was found. The article is prefaced by a brief discussion of the theory of glaucoma, and studies made by others on the action of doryl and similar drugs are summarized.

Harry K. Messenger.

Athens, A. G. **Glaucoma associated with hyaline bodies (drusen) of the optic disc.** Amer. Jour. Ophth., 1941, v. 24, Oct., pp. 1138-1143.

Cowan, T. H. **Retinochoroiditis of the Jensen type with secondary glaucoma.** Amer. Jour. Ophth., 1941, v. 24, Dec., pp. 1429-1431.

Dashevskii, A. I. **The effect of darkness on the blind spot, and on the angioscotoma of the glaucomatous eye.** Viestnik Opht., 1941, v. 18, pt. 4, p. 368.

This laboratory investigation dealt with the comparative evaluation of functional and tonometric data in the provocative tests for glaucoma. Dashevskii concludes that the effect of confinement in darkness for one hour, as in Seidel's test, can be more accurately judged by a study of the blind spot and angioscotomata than by tonometric data. Seidel's test interpreted tonometrically is reliable in only one third of the cases and is not suitable to eyes with rigid pupils, which dilate but little in the dark. This study consisted of 115 examinations of 59 patients classified as follows; 16 with bilateral glaucoma, 9 with bilateral prodromal glaucoma, 7 with unilateral glaucoma, and 13 with normal eyes. The functional study included determination of the size of the blind spot of the macular angioscotoma, and of a large angioscotoma 45° from the horizontal. The patient was then confined in a dark room for 45 minutes, after which the threshold of light sensitivity was determined with the author's adaptometer, and an artificial 2-mm. pupil, and the campimetric measurements repeated. Pilocarpine was then instilled, the patient confined again for 45 minutes in darkness, and light sensitivity and campimetric studies taken once more. The examination thus demonstrated the effect of darkness and of pilocarpine on light sensitivity and on the size of the angioscotomata. In all cases of demonstrated and prodromal glaucoma there was a decided enlargement of the blind spot and of the angioscotomata after remaining for one hour in darkness. The effect of pilocarpine, which raises light sensitivity and diminishes the size of the blind spot and of angioscotoma in glaucomatous eyes, confirms the data on the effect of darkness. The author believes that this combination of functional tests gives 100 percent accurate results in the early diagnosis of glaucoma.

Ray K. Daily.

Endo, Sigeru. **Effect of pressure-reducing operations on the flow of aqueous humor.** Jour. Oriental Med., 1941, v. 34, pp. 1167-1183.

The effects of trephining, iridectomy, cyclodialysis, and cycloradiothermy on the perfusion of a colloidal solution are reported. In most cases the amount of the flow is increased, and a reverse flow is not produced. Shiro Tashiro.

Endo, Sigeru. **Experimental glaucoma.** Jour. Oriental Med., 1941, v. 34, pp. 1185-1195.

Twenty percent or more of the eyes perfused with colloidal solutions developed glaucoma, blood serum being most effective and gelatin solutions next. Acidity of the solution and high perfusion-pressure favor the production of increased pressure. Atropinized eyes do not develop glaucoma nor do those subjected to pressure-reducing operations, but pilocarpinized eyes do. Detailed histologic findings are described. Shiro Tashiro.

Endo, Sigeru. **Genesis of glaucoma and the effect of the pressure-reducing operation.** Jour. Oriental Med., 1941, v. 34, pp. 1197-1203.

The genesis of human glaucoma is discussed on the basis of histologic findings. Trephining and cycloradiothermic treatment are recommended for glaucoma simplex, and iridectomy and cyclodialysis for inflammatory glaucoma, especially in its primary stage. Shiro Tashiro.

Garrow, A., and Loewenstein, A. **Hydrophthalmia.** Brit. Jour. Ophth., 1941, v. 25, Nov., pp. 508-521.

A clinical and histologic description of a case of hydrophthalmia in a boy 14 years of age. Both eyes were trephined, with great pressure evidenced by spouting of aqueous from the left eye. Following operative recovery the boy was brought in for regular observation. He was reported to have sufficient sight to read his school books. An unfortunate accident resulted in enucleation of the left eye and eventual loss of sight of the other eye from iridocyclitis. (Figures, references.) D. F. Harbridge.

Gralnick, Alexander. **The retina and intraocular tension during prolonged insulin coma.** Amer. Jour. Ophth., 1941, v. 24, Oct., pp. 1174-1185.

Hess, Leo. **Pathology of acute glaucoma.** Arch. of Ophth., 1941, v. 26, Aug., pp. 250-259.

The anatomy of the involved structures and the function of the ciliary ganglion are discussed to show that acute glaucoma is a neurovascular condition dominated by the ciliary ganglion. Glaucoma has its analogy in certain pathologic changes of the liver, the kidney, and the spleen. In the clinical picture of acute glaucoma one must differentiate primary irritation or stimulation of parasympathetic nerve fibers, and secondary spontaneous counteraction in the sympathetic fibers. The author considers the ciliary ganglion and all the neuro-elements within the globe as a unit, and the ciliary ganglion as the center for all nervous impulses arising within the eyeball. He believes that parasympathetic stimulation plays a primary role in glaucoma and suggests that there may be a neural control of the venous circulation of the eyeball which dominates its velocity and direction. J. Hewitt Judd.

Meves, Harald. **The behavior of the intraocular pressure when the water content of the body is increased with the aid of Pituglandol.** Graefe's Arch., 1940, v. 142, pts. 1 and 2, pp. 41-57.

The author demonstrated an improved Marx drink test for latent glau-

coma. The water content of the body was increased by forcing fluid and injecting Pituglandol (posterior pituitary hormone). The Pituglandol by urinary suppression maintained the high body water content for several hours. Twelve trials were made on ten patients, six with primary glaucoma and four with secondary glaucoma. Two normal patients were used as controls. Pituglandol (1 c.c.) was injected subcutaneously followed by the administration of one liter of water. In nine patients Pituglandol and water were administered a second time 1½ hours after the first injection. The intraocular pressure, blood pressure, and urinary output were measured hourly until urinary output became normal.

Nine of the 12 trials on glaucomatous eyes showed a rise in the intraocular pressure corresponding to the intake of water and suppression of urine. As soon as diuresis set in or one to two hours later the intraocular pressure fell to normal. In the two normal eyes there was only a brief and insignificant rise in the tension. In seven of the nine cases in which Pituglandol was injected a second time there was a second rise in tension higher than the first. Pituglandol injected alone produced no change in the tension. Pituglandol causes water retention and thus dilutes the blood; it also causes an abnormal loss of potassium, sodium, and chlorine from the blood, thus lowering osmotic pressure. There is a consequent passage of water into the tissues, for which a normal eye can compensate but not a glautomatous eye. Frances C. Cogan.

Schmidt, R. **Veritol as a mydriatic and pressure-reducing agent.** Klin. M. f. Augenh., 1941, v. 106, April, pp. 429-442.

In 80 cases where 5-percent veritol was used to dilate the pupil, 40 obtained a pupillary diameter of 7 mm. or more. The pupils reacted normally to light and convergence. The accommodation was not disturbed. The intraocular pressure was lowered in five of 15 normal cases. In cases of glaucoma the best results were found in chronic and in secondary glaucoma with few inflammatory symptoms. In contrast to other pressure-lowering drugs, veritol does not contract the pupil. (4 tables, 3 graphs.)

Gertrude S. Hausmann.

Uribe Troncoso, M. **Value of gonioscopy in the prognosis and treatment of glaucoma.** Amer. Jour. Ophth., 1941, v. 24, Dec., pp. 1396-1401.

9

CRYSTALLINE LENS

Aliquò-Mazzei, Alessandro. **The metabolism of purine substances and cataract.** Lettura Oft., 1938, v. 15, May, pp. 163-179.

The researches conducted by the author on the endogenous purine metabolism in comparatively young patients with cataract (no patients in the author's series of 29 cases was over 62 years of age) indicated an inconstant hyperuricemia (in 41 percent of the cases), and a diminished elimination of uric acid, even in many cases where the blood uric-acid level was within physiologic limits. Analogous results were obtained in five cases of endocrine cataract. The author reviews briefly various theories of the causation of cataract. On the basis of his own researches here presented he surmises that hyperuricemia may exert a direct influence upon the crystalline lens because of the presence of uric acid and other purine substances in the aqueous, or that it may affect it indirectly by

lowering the local pH. He calls attention to earlier investigations which showed that of all the ocular tissues the lens has the greatest power of fixing and retaining uric salts.

Harry K. Messenger.

Müller, H. K., Sohr, H., and Bruning, A. **Preliminary investigation on the question of medical treatment of the lens.** Graefe's Arch., 1940, v. 141, pt. 6, pp. 621-632.

This paper deals with experiments undertaken to determine the method by which maximum concentrations of glucose, glutathione, and ascorbic acid could be obtained in the aqueous. This is preliminary to an investigation of the effect of medical treatment on the lens. Three methods of administration were investigated in rabbits. The first was by injection of the test substance into the ear vein of animals anesthetized with urethane. Two series of animals were tested. In one the test substance was given in increasing amounts and the aqueous was examined before injection and 60 minutes after to determine its concentration. In the other the test substance was injected in a fixed amount and the aqueous was examined before injection and at varying intervals afterward (a half hour, 1, 2, 4, and 6 hours). The second method of administration investigated was by use of eye baths containing the test substance. The eye baths were of different strengths and were administered for different lengths of time (10 to 45 minuts). A variety of local anesthetics were tried: cocaine (5 percent), pontocaine (0.5, 1, and 2 percent), and psicaine (1 percent). The third method investigated was that of subconjunctival injection of a fixed amount of the test substance. The aqueous was tested before the injection and at various time intervals thereafter (1 to 6 hours).

It was found that the maximum glucose content of the aqueous could be obtained by eyebaths of 30-percent glucose solution administered for 45 minutes with 2-percent pontocaine as the local anesthetic. For clinical use 0.5 to 1-percent pontocaine is recommended as not so likely to cause corneal clouding. In human beings it was found that glucose solutions of 40 to 50 percent could be used as often as twice a day without damage to the eye.

The same method was found to be the most successful in raising the glutathione content of the aqueous, but none of the methods tried produced a high concentration. Intravenous injection was the method of choice for ascorbic acid, but this was found to be more effective if supplemented by subconjunctival injections and oral administration as well as eye baths of highly concentrated ascorbic acid.

Frances C. Cogan.

Neuschüler, Ignazio. **Considerations on the extraction in toto of the cataractous crystalline lens.** Lettura Oft., 1938, v. 15, Jan., pp. 3-14.

These considerations are based on 143 selected cases, There were eight instances of loss of vitreous, one of luxation of the lens into the anterior chamber, and one of accidental iridodialysis (through faulty technique). Prolapse of the iris occurred in 14 instances (but only in extractions done without an iridectomy or with only a basal iridectomy), displacement of the pupil upward in one instance, and spontaneous hyphema in two instances. Expulsive hemorrhage, glaucoma, and separation of the retina were not encountered. The author's opinion is that there is no greater risk of these complications than in extracapsular extraction, and that

the technical and mechanical difficulties are hardly greater. The following advantages are noted: (1) possibility of operating before maturity, (2) simpler postoperative course, (3) avoidance of secondary cataract, and (4) better functional results. Harry K. Messenger.

Newell, R. R., and Borley, W. E. **Roentgen measurement of visual acuity in cataractous eyes.** Radiology, 1941, v. 37, July, p. 54.

The dark-adapted retina is somewhat sensitive to the X ray. Apparently visual purple is necessary for vision with X ray, as the dark-adaptation curve is similar to that for light. On an energy basis light is 5,000 times as efficient as X rays for retinal stimulation. The authors used a rather elaborate technique employing circular stencils to measure visual acuity to X ray. Twenty-four patients with scotomata and 61 cases of cataract were checked for visual acuity by X ray. In most cases it was possible to prognosticate on the visual results following cataract operation. John C. Long.

Olmsted, J. M. D., and Morgan, M. W., Jr. **The influence of the cervical sympathetic nerve on the lens of the eye.** Amer. Jour. Physiology, 1941, v. 133, July 1, p. 720.

The authors find that the anterior surface of the lens actually flattens during stimulation of the cervical sympathetic nerve.

Theodore M. Shapira.

Theobold, G. D. **Histologic eye findings in arachnodactyly.** Amer. Jour. Ophth., 1941, v. 24, Oct., pp. 1132-1137.

Wolfe, O. R., and Wolfe, R. M. **Hereditary cataracta caerulea.** Jour. Internat. College Surg., 1941, v. 4, Aug., p. 322.

Three cases of blue cataracts are reported. The patients were a mother aged 50, a daughter aged 18, and a son aged 20 years. The mother had a bilateral cataract extraction by the Barraquer technique. The cataracts in the other two patients were removed by mouth suction through a keratome incision. Eventually the corrected vision in all six eyes was 20/20.

John C. Long.

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RETINA AND VITREOUS

Beatty, S. R., Owen, G. C. and Mackoy, F. W. **Schüller-Christian disease.** Radiology, 1941, v. 37, Aug., p. 229.

This is usually a rapidly progressive, fatal disease of early childhood. The authors report an example of the disease in a 47-year-old woman, the sixth case reported in the literature in a person over forty. The onset of the disease had begun with diabetes insipidus at the age of 26. There had been attacks of pain and swelling of the left hip, scalp, and ankle. X rays showed considerable involvement of the ilia, sacrum, and femurs. These lesions responded well to radiation. The diseased skull had no X-ray therapy. The only eye lesion was a sharply outlined, semicircular, slightly elevated white area, below and to the left of the disc and about twice its area. This was thought to be the result of lipoid infiltration.

John C. Long.

Belgeri, F., and Dusseldorp, M. **Probabilities of cure in retinal detachments.** La Semana Med., 1941, v. 48, Oct. 2. pp. 802-807.

The statistics given in this article would have been more valuable if the authors had stated what they meant by a cure of retinal detachment. They

do not indicate whether they mean a mere anatomical reattachment, or a definite standard of restoration of vision.

The importance of early operation is emphasized by the statements that 55 percent operated upon within three weeks showed cure, 48 percent within three months, and 40 percent within one year. The prospect of cure also diminished with greater size of tear, and with greater number of tears.

Disinsertion was not seen after the age of 49 years, nor a hole at the macula under thirty years. When no tear is found, the patient should be kept at rest in different positions, and the examination repeated with an intense ophthalmoscopic light. If the tear is still not found, a diathermic puncture is made beneath the most detached area, with slight pressure on the eye to cause escape of subretinal fluid. In one case the authors were surprised to obtain a cure by this single diathermic puncture in a detachment without visible tear. W. H. Crisp.

Braun, Reinhard. **The histologic findings in bilateral senile pseudotumor of the macula, leading to a new interpretation of this senile change.** Graefe's Arch., 1940, v, 141, pts. 4 and 5, pp. 567-568.

This is a note on an article by Sandoz (Amer. Jour. Ophth., 1940, v. 23, p. 596). Braun points out that he had previously published a similar case and had come to the same conclusion as Sandoz, namely that senile pseudotumor of the macula (disciform degeneration) arises from the choroidal tissue rather than from the pigment epithelium. Frances C. Cogan.

Cowan, T. H. **Retinochoroiditis of the Jensen type with secondary glaucoma.** Amer. Jour. Ophth., 1941, v. 24, Dec., pp. 1492-1431.

Feldman, J. B. **Light threshold.** Arch. of Ophth., 1941, v. 26, Sept., pp. 466-471.

Dark adaptation may be studied by either the qualitative or the quantitative method. The qualitative test, in which only a single light threshold is taken, is useful when large groups are to be examined. With the quantitative test, however, a number of thresholds are taken at fixed intervals in succession and usually for a period of thirty minutes. This method should be used for an intensive study of a particular type of disease. Pathologic dark adaptation was commonly observed in patients with renal calculi, thryotoxicosis, and certain types of hepatic disease. In a large number of diseases threshold studies are valueless. In ophthalmology, a pathologic dark adaptation is observed often in cases of glaucoma, but cannot be relied upon as a diagnostic sign in the so-called preglaucoma stage. However, the dark-adaptation test may be found useful in the prognosis when operation has recently been performed for glaucoma or when sympathetic ophthalmia is suspected. There appears to be some linkage between glaucoma, dark adaptation, and blood cholesterol. In cases of night blindness of the true idiopathic type, dark adaptation is pathologic, but the plotted graph is not always characteristic for the condition. In cases of retinitis pigmentosa, the highest type of pathologic changes in dark adaptation is observed, regardless of the degree of retinal involvement, and the changes are so pronounced that the graphs may be said to be characteristic for this condition. In the author's cases massive doses of vitamin A were given intramuscularly daily for several months to a number

of patients without any effect. (Discussion.) J. Hewitt Judd.

Ford, Rosa. **Central retinitis in a girl aged eighteen years.** Brit. Jour. Ophth., 1941, v. 25, Nov., pp. 521-523.

A case of central retinitis with recovery is reported. The cause was not revealed, all medical, dental, nasal, X-ray, and Wassermann investigations proving negative. The author thought that there might be some hidden septic infection in the sinuses even though clinically and radiologically they appeared normal. The treatment consisted of placing daily in each side of the nose a small piece of wool soaked in peroxide, leaving it in place for twenty minutes. Improvement was as rapid as had been the development of the disease. Seven and a half years later the patient was experiencing no further trouble with her eyes.

D. F. Harbridge.

Greenberg, R., and Popper, H. **Demonstration of vitamin A in the retina by fluorescence microscopy.** Amer. Jour. Physiology, 1941, v. 134, Aug. 1, p. 114.

There are two types of vitamin-A distribution in the eye: (a) in the ciliary processes, and (b) in the pigment coat and rods and cones of the retina, where it is functional and does not depend on the nutritional state.

Theodore M. Shapira.

Koyanagi, Y. **The physiologic secretory activity of the retinal pigment epithelium in the nourishment of the outer retinal layers.** Graefe's Arch., 1940, v. 142, pt. 3, pp. 304-310.

The author takes issue with the thesis recently expressed by Kyrieleis that the pigment epithelial layer is a passive filtration membrane. As evidence for the vital activity of part of the epithelium the author reports experiments in which a dye, Tolidin (not Toluidine) blue, is taken up by the epithelium when injected into the vitreous but not when injected into the blood. To demonstrate the former, 0.1 c.c. of 0.25 to 0.50-percent aqueous solution of the dye was injected into the vitreous of albino rabbits after evacuation of the anterior chamber, and the eye enucleated 3 to 7 days subsequently. It was then found that the dye was present in the pigment epithelial cells, but that there was none in the retina, showing the elective absorption of the dye by the epithelium. Epithelial cells also were noted to be enlarged and showed increase in granules. A somewhat similar elective absorption was present with India-ink particles. On the other hand, when the dye was injected intravenously in amounts of 10 to 20 c.c. of 1-percent Tolidin blue daily for 1 or 2 weeks the choroidal stroma was found to contain the dye but none was present in the epithelial cells. From this the author concludes that the pigment epithelium has the property of absorbing Tolidin blue and India ink (? foreign-body reaction) from the vitreous side but keeps the dye out from the blood side. This can be explained only on the basis of vital activity on the part of the epithelial cells and is inconsistent with the concept of a simple filtration membrane. This vital activity probably serves a nutritive requirement of the outer retinal layers. (Illustrations.) Frances C. Cogan.

Lobeck, E. **Fundamentals of localization of the hole in operation for retinal separation, with special regard to the height of the retinal elevation.** Graefe's Arch., 1940, v. 142, pts. 1 and 2, pp. 82-112.

The author uses a combination of the methods of Gonin and Weve for localization of the hole in retinal separation. This he finds satisfactory except in separation where the retina is ballooned out considerably above the choroid. In such cases the meridian of the hole can be accurately localized by Gonin's method but not its distance from the ora serrata. The hole is localized farther back than the position it assumes when the subretinal fluid is evacuated. The same holds true for Weve's transillumination method. If the height of the retinal elevation above the choroid is determined, the actual position the hole will assume with the retina lying flat can be determined mathematically. The author has worked out extensive tables giving the corrections necessary in emmetropic and myopic eyes for elevations at various distances from the ora serrata.

Frances C. Cogan.

Mügge, Felix. **A case of bilateral gumma of the retina.** Graefe's Arch., 1940, v. 142, pt. 3, pp. 311-318.

The case history and clinical examination of a patient with bilateral retinal tumor, presumably gumma, are reported, followed by a discussion of the pertinent literature. The patient had had an acute infection with what appeared to have been syphilis eight months prior to the author's examination and had been treated with twenty injections of mercury and nine of neosalvarsan six months previously. Despite improvement in general symptoms vision failed. Ophthalmoscopic examination showed narrowing of the arteries and a white elevated mass several times the size of the disc in both eyes. There were corresponding sector-like defects in the visual field. No conspicuous signs of inflammation in the eyes was evident. Large amounts of iodine (up to 4 gms.) were given daily and 2.5 to 5 percent salt solution was injected subconjunctivally. After two months the lesions had decreased in size and were less dense. After six months vision had improved from counting fingers at 2.5 meters to 5/7.5 in the eye where the lesion did not encroach upon the macula. The author was able to find five cases of gumma of the retina reported in the literature but all differed from the present case in being unilateral and in all except one there was active inflammation of the involved eye.

Frances C. Cogan.

Parkhill, E. M. and Benedict, W. L. **Gliomas of the retina.** Amer. Jour. Ophth., 1941, v. 24, Dec., pp. 1354-1373.

Sallmann, L. **Experimental studies on vitreous detachment.** Amer. Jour. Ophth., 1941, v. 24, Dec., pp. 1349-1353.

NEWS ITEMS

Edited by Dr. Ralph H. Miller
803 Carew Tower, Cincinnati

News items should reach the editor by the twelfth of the month.

Deaths

Dr. Arthur Elliott Owen, Lansing, Michigan, died October 8, 1941, aged 58 years.

Dr. Milton L. Martin, Denton, Texas, died September 27, 1941, aged 72 years.

Dr. Charles Clifford Archibald, Truro, Nova Scotia, Canada, died September 6, 1941, aged 63 years.

Dr. Marion Albert Andreen, Chicago, Illinois, died November 10, 1941, aged 47 years.

Dr. Max Talmey, New York, New York, died November 6, 1941, aged 74 years.

Dr. Stonewall Jackson Emory, Navasota, Texas, died October 7, 1941, aged 69 years.

Dr. Olaf Magneson Sattre, Rice Lake, Wisconsin, died October 27, 1941, aged 78 years.

Dr. George E. Gwinn, San Antonio, Texas, died September, 1941.

Dr. Anton Otto Frana, Chicago, Illinois, died November 18, 1941, aged 56 years.

Dr. Alonzo Graves, Russellville, Alabama, died October, 1941, aged 67 years.

Dr. Ray Wallace Moe, Peekskill, New York, died October 27, 1941, aged 61 years.

Dr. Lawson Henry Recher, Morocco, Indiana, died October 11, 1941, aged 85 years.

Dr. Jesse Wright Downey, Jr., Baltimore, Maryland, died November 18, 1941, aged 59 years.

Dr. Theodore Henry Lemmerz, Jersey City, New Jersey, died November 8, 1941, aged 71 years.

Dr. Robert Walker Hale, Thermopolis, Wyoming, died October 28, 1941, aged 72 years.

Dr. William A. Kriesel, Little Rock, Arkansas, died October 30, 1941, aged 71 years.

Dr. Lloyd Henry Sarchet, Wellington, Kansas, died November 14, 1941, aged 69 years.

Dr. Lawrence M. Gwinn, Denver, Colorado, died November 30, 1941, aged 53 years.

Dr. John Curtis Black, Bradenton, Florida, died November 26, 1941, aged 54 years.

Miscellaneous

At a dinner in New York City on October 6, 1941, it was announced that the Eye Surgery Fund, a local corporation, had been dedicated to the late Dr. Webb W. Weeks, professor of ophthalmology. Directing the fund is a medical board consisting of certain members of the faculty of the department of ophthalmology of New York University College of Medicine and the staff of the department of ophthalmology at Bellevue Hospital. Its aims include the promotion of research in surgery of the human eye, dissemination of knowledge in this field among physicians, and particularly performance of such work as may aid the indigent in need of eye surgery or medical care. While the scope of the fund is now local in character, it is hoped to extend it to a national basis.

A joint committee on industrial ophthalmology has been appointed by the Section on Ophthalmology of the American Medical Association and the American Academy of Ophthalmology and Otolaryngology to engage in appraisals of industrial visual-testing techniques, instrumentation, and interpretation of results, and to promote programs of education among workers, employers, the medical profession, and others. The Section on Ophthalmology is represented by the following committee members: Drs. Albert C. Snell, Rochester, New York, chairman; Arthur M. Culler, Dayton, Ohio; and Hedwig S. Kuhn, Hammond, Indiana, secretary. Members for the Academy are: Drs. Thomas D. Allen, Chicago; Edwin B. Dunphy, Boston; and John B. Hitz, Milwaukee. The new committee is working with the Council on Industrial Health of the American Medical Association to further their aims.

The Gill Memorial Eye, Ear, and Throat Hospital announces its sixteenth annual Spring Graduate Course from April 6 to 11, 1942. The following physicians will participate in the ophthalmologic program: Drs. Edwin B. Dunphy, Boston; Earl L. Burky, Baltimore; Harvey E. Thorpe, Philadelphia; Wendell L. Hughes, New York; R. Townley Paton, New York; Plinio Montalván, New York; also Mr. Aurel E. Mangold, New York. The subjects chosen will provide an interesting and well-rounded course.

Societies

On Tuesday and Wednesday, January 20th and 21st, the Massachusetts Eye and Ear Alumni Association participated in a program in conjunction with the New England Ophthalmological Society and the New England Otolaryngological Society. A surgical clinic was held on Tuesday morning and, following the presentation of interesting cases in the afternoon, the three hundred forty-fourth regular meeting of the New England Ophthalmological

Society took place, Dr. E. E. Holt, Jr., presiding. Dr. Alan C. Woods delivered a lecture on "Studies on sensitivity and the therapeutic use of tuberculin in experimental ocular tuberculosis." A surgical clinic, held again on Wednesday morning, was followed by a session of lectures. These consisted of: "Corneal transplantation," by Dr. Brendan Leahy; "Effect of local anesthetics on regeneration of corneal epithelium," by Drs. George Liebman and Trygve Gundersen; "Water movements in the eye," by Drs. Kinsey, Grant, and Cogan; "New test for stereoscopic vision," by Dr. Frederic Verhoeff; and "Orbital abscess with thrombosis of cavernous sinus," by Dr. Alexander MacDonald.

The Los Angeles Society of Ophthalmology and Otolaryngology appointed the following officers for 1942: Dr. John Osborn, president; Dr. Gil J. Roberts, vice-president; Dr. Colby Hall, secretary-treasurer; and Dr. Harold Mulligan, committeeman. Meetings are held on the fourth Monday of each month from May to September at the Los Angeles County Medical Association Building, 1925 Wilshire Boulevard, Los Angeles.

On January 6th the Saint Louis Medical Society held its annual meeting and installation of officers with a reception to the president, Dr. Frederick E. Woodruff.

Personals

Dr. Clarence H. Albaugh announces the opening of his office at 1130 Roosevelt Building, Seventh at Flower, Los Angeles; practice limited to ophthalmology.

On October 28, 1941, Dr. Arthur J. Bedell, Albany, was the guest of honor of the Omaha Mid-West Clinical Society. He delivered two addresses, "Medical ophthalmoscopy" and "The ophthalmoscopic evidence of injury to the eyes." He also conducted a clinic on "External diseases of the eye."